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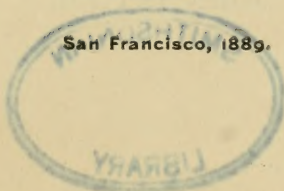
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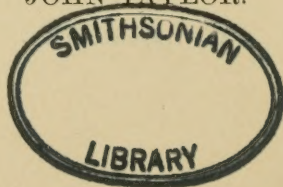
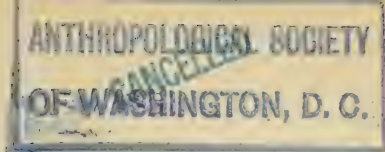


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PROCEEDINGS
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CONTRIBUTIONS TO THE MINERALOGY OF THE
PACIFIC COAST.

BY W. LINDGREN, U. S. GEOL. SURVEY.

1. Chromiferous Chlorite.

The great serpentine belt crossing the North Fork of the American River, above Dutch Flat, contains several deposits of chromite, some of which are worked on a small scale. While examining the ore from one of these occurrences—Green Valley, in the cañon of the American River below Towle's on the Central Pacific Railroad—I found coatings of a scaly mineral of a beautiful peach blossom color, together with smaller pieces of the same mineral in massive state. The substance proved to be a chlorite, and is most closely allied to that variety of *clinochlore* to which Kokscharow* has given the rather harshly sounding name of *kotschubeite*. With a magnifying glass the scaly coatings are seen to be composed of thin hexagonal tables from

* Bull. Ac. St. Petersburg, 369. 1861.

0.2 mm. diameter down to the smallest dimensions, often roughly arranged in rosette form; also of smaller fibrous masses of the same mineral. Under the microscope these latter are mixed with minute grains of uwarowite and chromite. The mineral in its massive state is grown together with chromite, shows a fine parallel fibrous structure and a pale purplish color. The crystals are hexagonal tables with perfect cleavage parallel to the base, apparently bordered by oR , and small faces of a striated R , the sign of which cannot be ascertained; it is too small to give signals in the goniometer, and the very slight thickness of the tables prevents accurate measurements with micrometer and micrometer screw. $H.=2$. $G.$ (massive variety)=2.69. Streak white. Lustre of cleavage face somewhat pearly.

Under the microscope the tables, when resting on their base, are transparent and of a pale purplish color. Between crossed nicols the crystals prove to be double-refracting and biaxial. The apparently strictly hexagonal tables are twinned monoclinic crystals; the most regular forms are usually divided in six sectors having a common apex in the center and their axes of elasticity in different position. See Fig. 1, in which the shading indicates the position of the plane of the optical axes in each sector. The colors of interference are low on the base, not exceeding the greys of the first order; those of the fibrous aggregates are more vivid, more so in fact than is usual with the chlorites.

In convergent light the plane of the optical axes is found in each sector to be parallel to its base; angle of the optical axes quite large, probably about 30° . Double refraction positive. The character of the dispersion cannot be well observed on account of the small size of the crystals.

The acute bisectrix stands nearly normal to the base, oP , and the extinction of the fibres is consequently quite small. Pleochroismus distinct: a & b purplish, c (vibrating perpendicularly to oP) yellowish red.

The division in regular sectors, as indicated by Fig. 1, is found among the crystals; but frequently the sectors are more irregular. See Figs. 2, 3 and 4.

FIG 1.

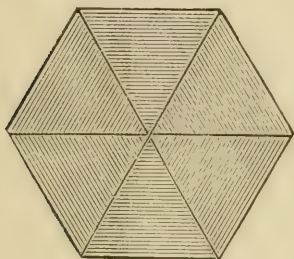


FIG 2.

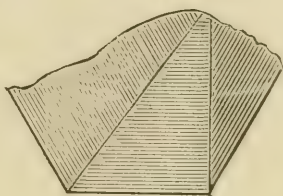


FIG 3.

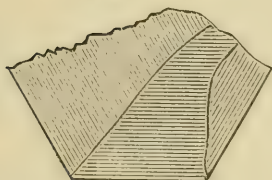
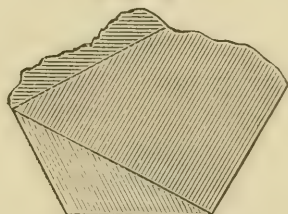


FIG 4.



Before the blowpipe the mineral becomes greenish white, and is fusible on the edges with great difficulty. With fluxes strong chromium reactions.

An analysis of the massive variety which Dr. W. H. Melville, of the U. S. Geological Survey, had the kindness to make, gave:

Loss at	105°	(H ₂ O)	0.365 %
Loss above	105°	(H ₂ O)	12.678 "
		Si O ₂	31.740 "
		Cr ₂ O ₃	11.392 "
		Al ₂ O ₃	6.741 "
		Fe O	1.231 "
		Ni O	0.487 "
		Ca O	0.183 "
		Mg O	35.178 "
			99.995

The material was free from chromite and uwarowite.

To facilitate comparison, I give here one of the many analyses of *kämmererite* (from Dana's Mineralogy), and v. Leuchtenberg's analysis of *kotschubeite*.

	kämmererite. Texas, Pa.	kotschubeite. Ural.
H ₂ O	13.20 %	12.63 %
Si O ₂	31.31 "	32.67 "
Cr ₂ O	2.98 "	4.09 "
Al ₂ O ₃	12.84 "	13.18 "
Fe O	2.46 "	2.22 (Fe ₂ O ₃)
Ni O	0.45 "	
Ca O	0.82 "	
Mg O	35.02 "	35.65 %
	99.08	100.53

The two forms of chlorite, *penninite* and *clinochlore* (ripidolite in Dana's Mineralogy) have, according to Rammeisberg, substantially the same composition, and differ only in their crystallization, *penninite* being hexagonal, and *clinochlore* monoclinic. Both have varieties rich in chromium: that corresponding to *penninite* being *kämmererite*, occurring in the Urals, and at the well known locality of Texas, Pa. It has been proved to be uniaxial by Descloizeaux* and J. P. Cook, Jr.† Various authors have also designated it as rhodophyllite, chromchlorite, rhodochrom. The chromiferous variety of *clinochlore* *kotschubeite*, from the Urals, has been described by N. v. Leuchtenberg,‡ but has since then, as far as I am aware, not been noticed from any other part of the world, and its occurrence in California is therefore not without interest.

v. Leuchtenberg arrives at the conclusion that *kotschubeite* is a variety of *clinochlore*, but differing from it in the

* Mineralogie. T. I.

† Am. J. Sc. II. XLIV, p. 201.

‡ Bull. Soc. Imp. de St. Petersburg. XIII, 34. 1869.

inclination of the acute bisectrix to the normal of the base; while this value amounts to 12° - 16° in clinoclhor, it has been measured to 1° - 2° in kotschubeite, v. Leuchtenberg's description applies entirely to the California occurrence as to the optical characters, but the crystal form differs. The mineral from Ural had the form of hexagonal pyramids, and was apparently composed of simple crystals, while that here described occurs as thin tables composed of three individuals, twinned according to the well known law of clinocllore, so as to appear as hexagonal crystals. In the position of the optical axis the crystals most resemble those of clinocllore from Texas, Pa., described by Cook.

A further and notable difference from Kokscharow's kotschubeite, and indeed from any known chromiferous chlorite, is in the very high percentage of Cr_2O_3 ; v. Leuchtenberg found 4.09 %, while the highest percentage of Cr_2O_3 , in kämmereite is 5.50 %.

The analysis of the California mineral shows more than twice that amount, viz.: 11.392 per cent, Cr_2O_3 replacing Al_2O_3 , but in other respects agrees well with those of kämmererite and kotschubeite given above for comparison. Nearly half a per cent. of Ni_2O also enters into the composition of the mineral; it is similar in this respect to kämmererite, which often also contains a small amount of this metal.

In the collection of the State Mineralogical Museum, there is one specimen of chromite from near Jackson, Amador County, covered by a thin coat of massive, peach blossom colored chromiferous chlorite. Whether it is kämmererite or kotschubeite, is difficult to decide.

2. Uwarowite.

Together with the kotschubeite, mixed with it as small grains or lining small fissures in chromite as almost microscopic crystals with brilliant faces, there occurs a deep emerald-green garnet. Under the microscope the crystals

prove to be almost perfect dodekahedrons. With fluxes, strong chromium reaction. H. above 6. Refraction very strong. Between crossed nicols some grains are isotropic, but the largest number faintly double refracting, some showing an approximate division in sectors. Garnets, as well known, often present abnormal phenomena of double refraction, and, according to Rosenbusch,* the uwarowite always shows these optical anomalies. Uwarowite is known from New Idria, California, occurring on chromite. (See Dana's Mineralogy.)

A green chromium mineral, also on chromite, from the vicinity of Livermore, Cal., given to me as trautwinitite, also proved to be uwarowite, in microcrystalline form.

Trautwinitite† is a mineral associated with chromite from Monterey County. In chemical composition it approaches uwarowite somewhat, but differs, according to Goldsmith, in its crystal form, it being hexagonal; it is, moreover, very soft, while uwarowite has a hardness approaching 7.

3. Scorodite.

At Steamboat Springs, Nevada, in the metamorphic series, metalliferous veins occur with arsenopyrites among other minerals. On this, in cavities and cracks, coatings of a leek green *scorodite* are found, which, under the microscope, prove to be often perfect crystals with the usual combination of pyramid and pinacoids (111.010.100). Refraction and double refraction very strong. This mineral has recently been found by Professor A. H. Chester, at the Hornsilver mine,‡ Utah, and as deposit from arseniferous thermal waters in the Yellowstone Park, by Mr. A. Hague,§ of the U. S. Geological Survey.

* *Microskopische Physiographie der Mineralien*, 2d ed., p. 269.

† E. Goldsmith. *Proc. Ac. Philad.*, 1873. 9. 348, 365.

‡ *Am. J. Sc.*, April, 1887.

§ *Am. J. Sc.*, September, 1887.

UNUSUAL NESTING SITES. II.

BY WALTER E. BRYANT.

Read December 5, 1887.

The entire material, with one exception, which comprises the present paper, has been received in brief notes or dictations from Messrs. W. Otto Emerson, A. M. Ingersoll and Chas. W. Knox, leaving the part taken by the author simply that of editor and compiler. The initials following the cases cited are those of the observers, to whom my thanks are due for communicating their interesting field observations.

Tyrannus verticalis.

ARKANSAS FLYCATCHER.—A nest was found built upon a fence-post more than half a mile from the nearest tree. It was secured from observation on one side by a board nailed to the post and projecting above it. (A. M. I.)

Sayornis nigricans.

BLACK PHOEBE.—A pair built for two consecutive years in a well four feet below the surface. The first year a second nest was built after the first had been taken. (W. O. E.)

Epidonax difficilis.

BAIRD'S FLYCATCHER.—A nest was built at the bottom of a hole five inches deep, made by a red-shafted flicker in a live oak. (A. M. I.)

Cyanocitta stelleri frontalis.

BLUE-FRONTED JAY.—A strange departure from the usual habits of jays was noticed in Placer County, Cal., where they had persisted in building within the show-sheds in spite of the noise and smoke of passing trains. The destruction of their nests by the men employed on the water

train, which makes two trips a week through the sheds during the summer, sprinkling the woodwork and tearing down the nests of jays and robins with a hook attached to a pole, seemed not to discourage them. So accustomed do the jays become to the passing of trains, that they will often remain on their nests undisturbed.

In one season more than two hundred nests of jays and robins were destroyed, so the train men say, between Cisco and Summit, a distance of thirteen miles. Some of the nests were but partially built, others contained eggs; these latter ones having probably been overlooked on previous trips.

The nesting of the jays within the snow-sheds is, so Mr. Ingersoll supposes, to avoid the persecution of squirrels. None, he thinks, however, succeed in rearing a brood, for of more than thirty nests which he found, nearly all were uncompleted. (A. M. I.)

Spinus tristis.

AMERICAN GOLDFINCH.—In 1884, a grove of young willows that had been occupied the previous season by a colony of tricolored blackbirds, was found deserted by them. Many of the blackbirds' nests still remained in forks of the willows from four to ten feet above the marsh. Six of these old nests were in possession of American goldfinches. The present tenants had loosely filled the nests about one-half full of cat-tail down, and had formed only a slight hollow for the nest proper. Some were found with eggs, and in others there *were* "birds in last year's nests." (A. M. I.)

Melospiza fasciata samuelis.

SAMUEL'S SONG SPARROW.—A nest containing three eggs was found in a round oyster can, which had lodged sideways among some driftwood in a willow tree. (W. O. E.)

Pipilo fuscus crissalis.

CALIFORNIA TOWHEE.—A pair constructed a nest in a five-gallon kerosene oil-can that lay on its side in a shallow

ditch. Part of one end of the can had been cut open, giving access to the birds. (W. O. E.)

Chelidon erythrogaster.

BARN SWALLOW.—A kind-hearted postmaster in the country nailed a shelf-like board against the porch above the entrance to his office, intending to give the crimson house finches a place to build. A pair of barn swallows took possession of this arrangement and built on top of it a nest composed of straw and feathers. This is the only instance I have known where this species used no mud in the composition of its nest. The position of this nest was less remarkable than the peculiarity of its structure. (A. M. I.)

A barn swallow's nest was built a few feet below the surface of a well which was in daily use, water being raised by means of a windlass and bucket. The weight of the growing young became so great that it broke the nest from the moist ground, and the young were drowned. A second nest was speedily begun upon a shelf of rock, nearly thirty feet below the surface, and not high above the water. Unfortunately, the result of this second attempt was not learned, for it would be exceedingly interesting to know how, if at all, the young were brought to the surface from so great a depth. (C. W. K.)

The nesting of another pair of these swallows was illustrative as much of persistency in nest building as it was of the unusual site which they eventually chose, prompted by repeated molestation. Three nests were built in succession; the first, containing five eggs, was taken from a partially abandoned mining tunnel, ten feet from the entrance; later, a second nest and five eggs was found, and taken nearly twenty feet from the entrance of the same tunnel. On subsequent visits a swallow would fly out as soon as Mr. Knox entered the tunnel, but the third nest was happily not discovered until the eggs had hatched. This nest was about fifty feet from the entrance, and under cover of partial dark-

ness the persevering pair had built and reared a brood. The finding of the last nest happened by chance. Mr. Knox had descended a shaft connected with the tunnel and was passing along the level with a lighted candle when he saw a bird fly from close before him, and aided by the light which he carried, the nest, with four large young, was found, but left undisturbed. (C. W. K.)

Tachycineta bicolor.

TREE SWALLOW.—A few years ago I found a nest with young in a crevice under the projecting and decayed deck of a lumber lighter, moored in Oakland harbor.

Vireo huttoni.

HUTTON'S VIREO.—A pair of vireos built this year in the outer branches of a live oak, only a few feet above the exhaust pipe from a steam pump, where at times they were compelled to suspend work, owing to the dense vapor which enveloped them. Four eggs were laid in this nest. (C. W. K.)

Cistothorus palustris.

LONG-BILLED MARSH WREN.—A conspicuous nest, containing eggs, was woven among the almost leafless branches of a young willow, five feet above a fresh water marsh. The false nests were built as usual, but in the coarse grass near by. (A. M. I.)

WEST COAST PULMONATA; FOSSIL AND LIVING.

BY J. G. COOPER, M. D.

(Continued from Bull. 8, page 514.)

C.—INTRODUCED SPECIES.

Zonites cultellatus Thomson. (See Bull. 4, 246)

Mr. J. H. Thomson, now of New Bedford, Mass., writes on this species as follows:

“In relation to my mistaking a specimen of *H. mormonum* for one of *Z. cultellatus*, I had, at the time of its discovery, never seen any specimen of the former, or any species found in California except those around San Francisco Bay. I went to the ‘southern mines’ in 1849, but got no land-shells there. In 1852 I lived on San Pablo Creek, $4\frac{1}{2}$ miles north of Redwood Peak. I found *Z. cultellatus* living in considerable abundance on the road from Oakland to the Redwoods, in a springy little valley.” This locality, as marked on a map by Mr. Thomson, is $2\frac{1}{2}$ miles northwest of the summit of Redwood Peak, at the head of a branch of Temescal Creek, and on the zone of calcareous tufa mentioned in Bull. 7, 373.

“Afterwards, several squatters settled there, and began raising hogs, poultry, etc. Next year I could not find any shells there; the hogs had eaten them. On my second visit to California, in 1854, I found the shell described by Mr. Binney as *H. anachoreta*, and three other kinds, on the east slope of the Contra Costa hills, near my house.

I have lately received a specimen of *H. mormonum* var. *circumcarinata* Stearns, and was struck with the great resemblance to my *Z. cultellatus*, only that this was smoother. I have not seen the latter for some years, as it is in the New York Museum.”

Mr. Binney also writes: "Thomson's shell was of the European group of *Z. acies*," found about the Mediterranean Sea. Mr. Thomson, having found no native species that could be confounded with it, and being so exact as to locality, as well as the cause of its extinction there, we must believe that the original stock was brought alive from Southern Europe by ship, about 1850, and was placed where it would probably become abundant, with a view of supplying the market in future, just as *P. pomatia* and other species have been introduced into many parts of the world for food supply; also, *P. aspersa*, at Santa Barbara and the Sandwich Islands. Though the location was well chosen, there was not sufficient shelter to protect them from the hogs.

As almost any large species may be introduced, by settlers, in this way, we may suppose that the single shell of the Mexican *P. buffoniana*, found in 1857 by Mr. Holder, on the bay shore at Alameda, was a relic of such an attempted colonization. The strange occurrence of *Orthalicus zebra* on Vancouver's Island, alive, as reported by Mr. Lord, may be another instance. (See P. P. Carpenter's Report on Mollusca of the West Coast of North America, 1863, p. 607.)

As accidentally introduced alive, I may refer to the specimen of *Athoracophorus* found in a bale of the "Pulu" fern brought from the Sandwich Islands for mattress making. (See Proc. Cal. Acad., v. 195, Nov., 1871.) I also received last year, through Dr. Harkness, a very young Bulimoid shell, living, found adhering to dried plants in a herbarium from Panama. If it had been the warm season, it might have survived and grown in a moist garden or greenhouse, like several other introduced species.

Ophiogrya heligmoidea D'Orbigny. (See Bull. 4, 248)

Mr. H. Moores, of Columbus, Ohio, writes about this shell: "The specimen was found just as stated, and was

kept separate on account of its peculiar form. There was no misplacing of labels or any other mistake about it. I hunted near there a year without finding another. I have tried for many years, in various ways, to have somebody interest himself regarding it."

Specimens of the new *Helicodiscus* (?) (No. 23, Bull. 7, 367) have been supposed to be young of the above; but, though resembling its inner whorls, cannot be the same species.

The discovery of fossil examples of *Gonostoma yalesii* five hundred miles north of its present range suggests that these sub-fossil shells of a tropical species may be remains of a former more northern extension.

Pomatia aspersa Müller.

Mr. Binney has received this shell from San Jose, Santa Clara county, where it was doubtless introduced for cultivation. The same species was reported from Santa Barbara in 1850, but may have been taken at the Sandwich Islands, where it was introduced by sailors. (See Amer. Jour. of Conch., v. 211, 1870.)

Limax agrestis Linn. (Bull. 7, 367, No. 2.)

Living specimens, collected by Mr. W. J. Raymond in his garden in Oakland, were sent to Mr. Binney for comparison with those now so common in the Atlantic States, where they were introduced with plants from Europe, and he considers them undoubtedly that species, probably brought here with roots of plants. It is thus likely to become a pest to gardeners, like *L. hewstoni*.

On the subject of the introduction of the latter, Mr. Binney was formerly doubtful, and thought it might be native, as he had a similar form from Southern and Lower California. But on comparing the alcoholic specimens again, he admits that they are not *L. hewstoni*, but either new, or *L. agrestis*. This cannot be decided without more perfect examples.

Hyalina cellaria Müller. (Bull. 7, 367, No. 16.)

This species, which follows commerce around the world, was found by Mr. W. Sutton numerous in a garden near the centre of San Francisco. The locality produced very large specimens, one measuring 0.55 inch in width. It may also spread with roots of plants, like many other species, and has already been reported by Mr. Binney from Portland, Or., being sometimes carried on ships' water-casks, and the eggs thus reaching shore.

D.—ADDITIONS TO CALIFORNIA SPECIES.

Hyalina subrupicola Dall. (Bull. 4, 254.)

One somewhat weathered specimen was found by me at Alta, Placer County, at about 3,600 feet elevation, and having sent it to Mr. Dall for identification, he writes that it is his species, "larger, somewhat, than the largest I had." Mr. Binney also examined it, and considers it "certainly not *indentata*," with which he had before combined Mr. Dall's types of the species from Utah. It was before doubtfully reported from caves of Calaveras County, Cal., as well as the cave in Utah where first found, but my dead specimen was from driftwood by a mountain brook, and not near any cave.

Hyalina binneyana Morse.

The shells from Vancouver's Island, mentioned in Bull. 4, page 253, as near *H. viridula*, were compared by Mr. Dall with the types of above, and found identical. It is thus first reported from this coast, and very likely to occur in the mountains of California, like most of the small boreal species. Mr. Binney reports *H. viridula* as found at Portland, Oregon, and in Utah. (Bull. Mus. Comp. Zool., xiii, 2, p. 42. "A 2d Suppl. to 5th Vol. of Terr. Moll.," 1886.)

Selenites cælata Mazyek. (Bull. 7, 367, No. 15.)

I have given this species in the list on page 367 (Bull.

No. 7) as *Mesomphix durantei celata*, as I consider it merely a sub-species, or perhaps only a variety of that species, differing chiefly in a thicker and coarser shell, caused by more abundant lime and moisture in the localities it inhabits on the mainland, than on the islands where the type was discovered. Mr. Binney agrees in this opinion.

***Succinea avara* Say.**

Mr. Binney (2d Suppl., p. 46), reports this eastern species also from California, but the locality is not given. It occurs in some regions east of the Sierra Nevada, but is not known yet on their west slope.

***Pupa arizonensis* Gabb.**

(*P. Vertigo*) ***Ovata* Say.**

These two species, referred to in Bull. 7, page 361, are also additions, the former only found on the east slope of the Sierra; the latter, a common eastern species, apparently straggling west to near San Diego.

E.—NEW NOTES ON NATIVE SPECIES.

Limacoids.

Referring now to the table of species given in Bull. 7. p. 367, I may further explain the reasons for grouping them, as there done, in different order from that adopted by the latest classifiers, who have so thoroughly investigated the internal anatomy of these animals.

Their external characters, besides being those most easily recognized, are also those by which they are brought under the effects of surrounding influences, and thus they become naturally grouped into series, of which the members exhibit similar relations to the laws of nature, independent to a great extent of their internal structure.

Although not claiming that this similarity in habits and appearance constitutes a basis for scientific grouping quite independent of their organization, it becomes necessary to use it in giving their history.

Thus, all the Limacoid species agree in absence of external shell, and therefore, while without that slight protection, can better escape their enemies, as well as the effect of droughts, fires, and cold, by crawling into fissures that the others cannot enter. They also suffer less by being washed down in the winter torrents, and follow retreating moisture as the streams dry up; so that some of Nos. 1, 4, 5, 6, 7, 8, 9, 10 may be found active all summer in damp cañons or spring-heads, along weedy brooks and edges of ponds. Near the bay Nos. 6, 7, 8 are, however, scarce after April, and Nos. 9, 10 after June.

Limax (*Amalia*) **hewstoni** J. G. C. (No. 3.)

There seems reason to believe that this species is of only annual existence, which may be the case also with the other Limaces, though I have not seen it published. They disappear with the first hot, dry weather, and are then found for a while in the burrows of animals a foot or two deep, where their eggs are deposited (also near the surface about wells and cisterns), but after July none can be found even in excavations five or six feet deep. After the ground is well soaked with rain in late autumn they reappear in numbers, but very few more than half grown, some of late broods, perhaps surviving in the wettest spots. As none are ever found far from gardens, they are absent where the native species survive in the dry season.

The variability in color among these shell-less mollusca is well known, but its origin in the principle of self-protection by mimetic accommodation has not been much remarked upon. In this species, and some others which feed chiefly at night and in cloudy wet weather, the blackish tints chiefly prevail, and seem to deepen after they first come to the surface, but specimens of *L. campestris* and *L. agrestis* are often found of light shades or with streaks resembling the nervations of dead leaves, among which they creep in the daytime.

In the large kinds of *Ariolimax*, Nos. 4 and 5, yellowish

is also the prevailing color, like that of many dead forest-tree leaves, and they are often blotched *irregularly* with black, like leaves mouldy or decayed. The small species and sub-species, *A. niger*, *andersoni* and *hemphilli*, are either black, or pale with dark specks irregularly scattered on or between the granulations, while the furrows separating these are of the same light color.

In *Prophysaon andersoni* and *hemphilli*, the furrows are darker than the tubercles, giving the "foliated" appearance ascribed by Dr. Gould to an Oregon "*Arion*" (which was probably of this more recent genus).

A black variety of the former was also found by W. O. Emerson on the Santa Cruz Mountains among burnt logs, where its color might have also been a protective variation.

My reason for making Nos. 7 and 8 only sub-species of No. 6 (*A. niger*), besides the local limitations before mentioned, are that they do not seem to differ from that species more than the forms of *L. campestris* called *montanus* and *occidentalis* differ from that species, and Mr. Binney now admits that they intergrade with it.

I am inclined to think that all the *Limacoids* except *Limax* are biennial, taking most of two years for their growth, and then dying, but some may live longer, especially those hatched late in the season.

Mr. Binney considers *Prophysaon andersoni* as "probably a distinct species," founding this opinion on the genital organs, but the differences in form noted are such as are likely to vary with season, and to change after oviposition. In either case, the specific name is prior to that of *P. hemphilli*, although I described it as an "*Arion*" before the later genus was separated, noticing its resemblance to *A. foliolatus* Gould.

Vitrinoid.

The distinctions separating this group from the *Helicoid* may be broadly stated as the absence of thickened expanded

lip to the shell, as well as thinner and plainer shells, though these characters differ from those derived from internal organs. In our native species, however, they serve very well to separate the two groups.

Mesomphix (*vancouverensis*?) *simplicilabris* Ancey. (No. 13.)

Mr. Binney, in 2d Supp., p. 41, calls this a variety of *M. voyana*, but unless confounded with immature shells of that form, it seems as nearly connected with the above, the shell as found near this bay having the smooth polished surface and undeflected lip of the young of the larger forms, with the small size and wider umbilicus of the small var. of *M. voyana*. That it is not a hybrid is shown by its not being found with either of the others, and it is very rare anywhere, appearing to be either a survival of an ancestral form, or a proof that *M. voyana* is a derivation from the larger forms. Mr. Binney writes about specimens I sent him:

"The lingual is like that of *M. vancouverensis*." He also remarks on the similarity of the shell to his new form, "*M. hemphilli*," from Washington Territory; but that is much larger, and with a contracted umbilicus. As *M. voyana* also intergrades with *M. sportella*, it seems as if all these forms must yet be considered as only subspecies, like those of some other west slope species.

Microphysa conspecta Bland. (No. 21.)

The unexpected appearance of these little delicate species in cultivated grounds is shown by the finding of this shell for the first time east of San Francisco Bay in 1886, at Haywards. A hanging basket, planted with ferns and covered with mossy bark brought from a cañon near by, was hung in my garden, and some months later I looked under the bark to see if any molluscs had remained in it. I found the above species abundant, and in a few weeks took out over one hundred, always finding more, still immature. After being unwatered for four months, and becoming quite dry, they revived on being moistened.

Mr. Binney writes that he once found a similar colony of *Hyalina exigua* in a fern garden in Boston. The resemblance of these two species externally is very great, but on account of differences in jaw and teeth, the former is put lately with the *Helicidae*. The similarity of habits now shown, in addition to their similar shells, is a strong argument for retaining both in one group. Mr. Raymond has also found it in a garden in Oakland.

Helicodiscus lineatus Say. (No. 22.)

In the "Manual of American Land-shells," Mr. Binney puts this among the "universally distributed species," (a division which might better be named circumboreal or boreal for those only North American), since many are *not* found far south of latitude 49°, or only along mountain ranges. He remarks that the specimens found by Hemphill at Oakland, Cal., and in Idaho, are without the colored lines from which the species was named. In this they resemble the undescribed form (No. 23), but unlike that, probably have internal teeth. This is a reason for deferring the description or naming of the latter until living specimens can be obtained. I have not heard of the former having been obtained by anyone else in California.

Helicoids.

Mesodon (*Aplodon*) **armigerus** Ancey. (No. 25.)

The recent separation of this form from the Oregonian *M. columbianus*, is fully elucidated in Binney's 2d Supplement, with illustrations. Considering, however, the occurrence of another variety in Plumas County (Bull. 7, 358), and that no specimens from the northwestern part of California have yet been compared with either of them, it seems probable that all the later forms will yet be found to intergrade with that first described, reducing them to subspecies.

Arionta arrosa Gould. (No. 26.)

I have lately seen several more specimens of the small form mentioned in Bull. 7, p. 372, labeled "*A. arrosa*, Alameda Co." by the finder, and probably from near the same locality. It is therefore not a chance straggler there, though rare and local only in or near "Redwood Cañon," just as it is found near the redwoods west and north of the bay. The size is less than that of coast specimens, but larger than some from Napa County, and though about equal to some of the varieties of *A. californiensis*, differs in seven whorls and other characters. Connecting links between the two are not found yet, though var. *holderiana* east of the bay comes very near some of the forms of var. *exarata* north of it.

A. (californiensis) ramnosa Gould. (No. 32.)

This form shows an ability to withstand droughts and heat, greater than any other of the large banded species of this coast. On the east shore of San Francisco Bay it is sometimes found in colonies along the sides of little gullies, washed out by springs which almost entirely dry up in summer, and where no rocks or trees shelter them, the largest vegetation being a coarse grass about five feet high, and annual herbage. They may be found in these stations torpid during about four dry months, partly concealed in slight cavities, and are remarkable for thickness of shell, derived from the fossiliferous soil of the pliocene terraces from which the springs flow. They are not found along the permanent streams near by, where rocks and shade abound, and where the thin form No. 30 is rather common.

A. anachoreta Binney.

In the synopsis (Proc. Cal. Acad., iii, 338.), I classed this bandless shell as perhaps identical with a form found near lat. 42°, and still of uncertain specific standing; but since I have collected near the place where Thomson found the

type specimen, and for fifty miles or more around there, I am satisfied that it is merely a bandless (perhaps diseased) specimen of one of the large species found there. Mr. Binney remarked its resemblance to *A. nickliniana*. It is perhaps as near var. *bridgesii*, which is the prevailing form where it lived, but may have been of var. *holderiana*. Similar accidental defects being found in all the banded species, it cannot be considered a subspecies, and scarcely a variety. The same may be said of the form called *nickliniana* Lea., a very uncertain type, while var. *bridgesii* is well defined. Bandless specimens of other forms are sometimes found.

Mr. Ancey, who is inclined to divide both genera and species too much, has recently made new names for the groups here included in *Arionta* and *Campylæa*, viz., *Helminthoglypta* Ancey, type *A. tadiculata* Binney, which he says differs much from *Arionta* (*arbustorum*) internally, and *Micrarionta* Ancey, types *C.? ruficincta*, *C.? gabbi* and *C.? facta*, which I consider of the same group as *C.? traskii*, *C.? fidelis*, etc., though he does not include these.

From his remarks on these two genera, I conclude that he retains the latter in LYSINOE (but still uses the generic name AGLAIA), giving the two new genera as the parallel series to *Arionta* and *Campylæa* of Europe.

A. exarata (Pfeiffer). (No. 35.)

It was intended to have the name of this shell in the column of species, like Nos. 26 and 30, but the printers put it with the subspecies. Should it yet prove to intergrade with either of the two, it will be with 26, not with 30.

C. ? (fidelis?) infumata Gould. (No. 36.)

In his "1st Suppl. to Terr. Moll. of U. S.," Mr. Binney has figured one of the links between the two so-called species here combined as "the smooth form of *infumata*," but does not mention the many intermediate gradations between the two, which perhaps he has not seen. It may,

however, be as well to continue to regard the original types of west-coast forms as distinct species, the intermediate links being generally confined to narrow geographical limits. It is a still unsettled biological problem whether different species of these low orders of animals may not originate new species by hybridization, some of the progeny being fertile, and perpetuated by natural selection. Mr. Binney, ("Man. of Amer. Land Shells," pp. 122-3, 1885) considers the two as identical, or varieties of one species, but they exhibit such a wide difference in their extreme forms as is not seen in any other known species, and must rank at least as sub-species.

C. ? infumata presents a curious instance of possibly preservative color-variation, as it commences to appear just south of the Oregon boundary, where a drier climate makes fires more frequent, and from its color is less easily seen by enemies among charred logs and leaves, while its lower, angled form, enables it to crawl under logs or into fissures of rocks, where *C. ? fidelis* cannot thus protect itself. Thus it exists with the depressed forms, 11 and 37, as far east as Solano County. The same may be observed of the angled and hirsute race of *C. ? monum*, called *hillebrandi*, found in the Sierra Nevada between lat. 37° and lat. 38°. A black variety of *C. ? sequoicola* has also been found in the Santa Cruz Mountains, where fires are so frequent and destructive, but no angled form of any kind is yet known in the southern Coast Range, although a fossil of that shape occurs on Santa Barbara Island, which I have referred to the living species *A. ? tryoni*, now only found rounded. (See Proc. Cal. Acad. VI., 17, 1875.)

It is not uncommon to find colonies of some of the large *Helicoids* killed by fire, a slight scorching of the shell being sufficient to kill them. It is thus evident that in the drier localities farthest from the coast where fires are likely to

spread most widely, the angled, or even the depressed shells, being best suited to crawl into the deep fissures of the earth, rocks, or under logs, must oftenest escape burning, and thus become the prevailing forms stocking those regions. Thus may be explained the distribution of such forms as *A. (cal.) ramentosa* (No. 32), which prevails over most of the two counties east of San Francisco Bay, while *A. exarata* takes the place of *A. arrosa* in most of Santa Clara valley, but is less common west of the Santa Cruz Mountains.

An approach to the angled form is sometimes seen in *M. armigerus* (No. 25), but as that species only lives in very damp places, this variety may be of different origin. The imperforate and toothed variety is given as Ancey's type, but the umbilicated toothless form is the most common, being very near that found in Plumas County.

Mr. Badger has lately brought from Eel River, Humboldt County, near lat. 40°, and perhaps 1,000 feet elevation, the largest specimens of *C. ? infumata* I ever saw. One belongs to Binney's smooth variety, but is nearly destitute of angle, and though very dark has a darker line on the body whorl. and traces of the impressed revolving grooves of *fidelis*. It measures in breadth 1.74 inch, axis 0.76, alt. 0.90, being of about three times the bulk of Alameda County shells, and with only traces of their peculiar epidermis, but is a dead shell somewhat worn. It is the largest land-shell I have seen from the west coast of the United States.

A smaller, less worn shell, from the same place, is more angled, but the surface even more like that of *fidelis*, shining beneath, but band very faint. They might indeed be almost called a black variety of *fidelis*, and are truly intermediate. The largest has about the width of the great *G. neuberryana* figured in Binney's 1st Suppl., Pl. IV., but is higher and heavier. With them are some of *A. arrosa*, very large and approaching the form I called *arboretorum* Val., also one *M. vancouverensis* nearer the Oregon shell than

those southward. These show the effect of the climate toward the northwest, and indicate a promise of new forms in that direction. Species are known to extend across the country for 150 miles inland, at short intervals, near lat. 40° to 41°, but are still very imperfectly known.

A Portland, Oregon, paper reports that the large species of that vicinity, *C. ? fidelis*, is sold there for food.

BIRDS AND EGGS FROM THE FARALLON ISLANDS.

BY WALTER E. BRYANT.

Read December 19, 1887.

Situated about thirty-five miles west from San Francisco, California, is a cluster, or rather three clusters, of rocky islands commonly known as the Farallones. Upon the charts, these islands are individually designated as North, Middle and South Farallones.

The latter island is the largest, and the only one inhabited; all the sea-birds that nest on the others are also found upon the South Farallon. It is regarding this island and the adjacent rocks that this paper will treat.

The islands have been occasionally visited by naturalists, but their stay has usually been of short duration, a few hours oftentimes; or, if they stayed for days, the time has been largely devoted to the accumulation and care of specimens rather than to the study of the birds which congregate in countless numbers during the breeding season.

Mr. W. Otto Emerson, who visited the South Farallon from June 14th to July 2d, 1885, and again from May 2d to June 2d, 1887, has generously placed with me his matchless collection of birds and eggs and his notes regarding them, for publication. Mrs. W. H. Rugg, wife of the chief light-keeper, has contributed interesting notes and data concerning many of the birds, particularly straggling species.

The first impression of the island, Mr. Emerson tells me, is that it is low, rounded and knoll-shaped; but on approaching nearer, it discloses its high, rough and rocky character. By the time the anchorage at Fisherman's Bay is reached, the island and adjacent rocks are seen to be fairly alive with birds, whose clamor and rushing wings, as

they rise—alarmed by the boat's whistle—can be compared only to a swarm of bees on a grand scale, at the time of leaving the hive and undecided what direction to take. Arch Rock, Sugar Loaf and East End seem, in places, to be covered with snow, as the sunlight falls upon the white breasts of the murre.

The South Farallon extends about a mile in length from east to west, and is nearly half as wide as long. It is of granite formation, with a broken ridge extending lengthwise and interrupted, in places, by precipitous bluffs and ragged, rocky points.

At the west end is the highest bluff, Indian Head, one hundred and five feet above the sea-level. From there a fine view can be had of part of Breaker's Bay, and along the whole side of the main island.

The shore-line is very uneven, long and narrow fissures running in from the sea and often extending under the rocks. One of these under passages has an opening on the island, and is supplied with a fog-horn which is blown by the rush of air driven through by the waves. From the summit of Tower Hill, the most elevated point, 343 feet above the sea, the North Farallones, seven miles away, can be plainly seen, with Middle Rocks lying between—a small group, one hundred and sixty-six feet at the greatest height. They are seldom visited, being dangerous to land upon.

No shrubs of any kind grow on the island. The principal vegetation consists of the Farallon weed (*Baria maritima*). This plant, and also *alfileria*, and the roots of *Lepigonum macrothecum* are eaten by the rabbits which inhabit the island. They were introduced from England by a sea captain, who brought over a few as a present to a former light-keeper; and they multiplied until there was not sufficient food to support them, many dying of starvation during a dry season. At times, they furnish the only fresh meat which the light-keepers and their families have during

weeks or months of stormy weather. Other plants have been introduced in the hay brought for "Jerry," the island mule, whose duty it is to haul the car over the tramway from the landing to the store-house.

The only fresh water to be had on the island is that which is caught during the rainy season and saved in cisterns. A few springs near the shore line are too strongly charged with guano to admit of their being used for drink.

Birds rarely or never fly against the light-tower, but occasionally strike the bell-wires running from the house to the tower.

The abundance of the breeding water-birds is estimated to be in the following order: 1. Murre. 2. Western Gull. 3. Cormorants (including three kinds). 4. Pigeon Guillemot. 5. Tufted Puffin. 6. Cassin's Auklet. 7. Ashy Petrel.

It is, of course, understood that the land birds of this catalogue are, in most cases, to be regarded as stragglers either driven off shore by high winds, astray in heavy fogs, or resting on their migrations to the north or southward.

During the bird-wave in May, 1886, the weather was unusually fair. No stragglers were noticed by Mr. Emerson in 1885. Mrs. Rugg saw a few that year.

1. *Lunda cirrhata*.

TUFTED PUFFIN.—Arriving at the island in pairs during the latter part of March, they associate in pairs until their single egg is laid, after which the one not sitting remains near the entrance to the burrow; the presence of this sentinel—which may be either male or female, as both birds take part in incubation—indicates a nest with a bird sitting.

They burrow when possible; otherwise, make use of natural cavities anywhere on the island for a nest. Sometimes a few pieces of weeds are carried in, but often no material is used in the nest.

It is always safe to wear a heavy glove when taking a bird from its nest. They will strike a few times at one's hand, and then retreat, if there is room; but if not, they become angered and bite viciously. One caught Mr. Emerson by a finger and bit it to the bone, holding on with bull-dog tenacity until killed.

When alighting, they hold the body and head low and then straighten up, adjust the wings and draw the head back proudly. On the rocks, or flying about, they are silent, but when two are in the same burrow they keep up what sounds like an angry quarreling and scolding. The sentinels, if alarmed, circle about; but when a person remains perfectly quiet they will soon return and light within a few yards. Their bright and oddly-shaped bill, white eyes and yellow nuptial tufts, which flutter in the wind, make them birds of peculiar interest to observe in life.

The food of the puffins was found by dissection to consist mainly of small fish, together with some algæ.

Young, with feathers plainly appearing through the down, were taken July 26, 1886.

I have carefully measured fifty puffin's eggs, which average 70.2 mm. x 48.4 mm. The individual proportions of eight eggs, showing the greatest and smallest extremes of both diameters, are 81 x 50; 77 x 48; 74 x 50; 71.5 x 51; 71 x 46; 65.5 x 45; 64 x 50; 63.5 x 50 millimeters.

2. *Ptychoramphus aleuticus*.

CASSIN'S AUKLET.—A strictly nocturnal species, flying during foggy, stormy or moonlight nights, but never at dusk. They arrive early in the year, coming in great numbers in the night of January 14, 1887. The auks do not fly until it is quite dark, and are supposed not to fly very high; otherwise more, it would seem, would strike the lighthouse. One, attracted by a lantern carried by Mr. Emerson, flew with characteristic swiftness directly at it, but missed and struck against the side of a house,

when it was picked up stunned. Auks have struck persons walking without a light, but always below the shoulders. From the balcony of the light-tower they could be heard below calling; their note is the most noticeable of the night cries, seeming to predominate over all other bird sounds, especially during stormy and windy nights.

On the Farallon Islands they do not burrow, but lay in natural cavities over the entire island, particularly where a pile of rocks afford concealment. The inhabited places may be known by the excrement accumulated about the entrance. They use no nest material, laying a single unmarked egg. Several young are supposed to be raised during the season. Many nests were found occupied by young in down and one adult bird sitting upon a fresh egg; in some nests the egg was kept warm by contact with the young. In no instance were two old birds found in the same nest, and no birds were found at the time search was made without an egg or young or both. The majority of adult birds taken were females, although both sexes were found sitting. If provoked, either young or old will seize a finger and hold on. The old birds are silent when on the nest, but the downy young make a faint peeping when disturbed. When taken from the nest, they endeavor to crawl out of sight, and if tossed into the air they descend quickly and hide themselves from the light. They commenced flying this year as early as April 2d; and eggs have been found as late as November 20th, 1886, showing a breeding time extending through eight months.

The eggs, when held to the light, show a pale shade of emerald green.

Fifty specimens measured average 45.3×32.5 mm. The extreme largest and smallest eggs were found to measure respectively 49×35 ; 48.5×33.5 ; 48×36 ; 47.5×36 ; 46×32 ; 43×32.5 ; 43×32 ; 42.5×34 millimeters.

I have taken measurements of examples of both sexes, the averages of which, in millimeters, are here appended.

Three males.—Wing, 127; tail feathers, 33.3; exposed culmen, 19.2; tarsus, 23.3; middle toe and claw, 36.2.

Five females.—Wing, 127.8; tail feathers, 32.5; exposed culmen, 19.8; tarsus, 23.9; middle toe and claw, 35.1.

3. *Cephus columba*.

PIGEON GUILLEMOT.—This species is one of the last to arrive at the island, and is to be found in pairs after May 1st.

When at rest they squat, duck-like, upon the rocks, holding the bill in horizontal position; occasionally a few will rise to a standing position, with their bills considerably elevated.

Previous to laying they gather in small groups, usually near the water's edge, and when disturbed rise to the standing position, and in this attitude, with open bills, they salute each other or returning fellows, by making a peculiar, whistling cry, that can be heard at all times of the day. After pairing they fight a great deal among themselves, chasing each other on the wing and engaging in combat on land and water. Mrs. C. M. Crowell, of Haywards, Cal., witnessed a fight in the water, which continued for ten minutes; they first held fast to each other's bills, then separating, one dived and the other swam about watching closely for the appearance of the first, which, on coming to the surface, was at once attacked and tormented until it finally dived and came up beyond reach of its adversary. If caught, they show a disposition to fight, but first will endeavor to escape by crawling away.

They lay wherever concealment can be found, in dark caves and fissures, under boulders, and the tramway wall; most of the nests were found on flats near the water's edge. Two eggs, the largest number found in one nest, are laid without any attempt being made at nest-building. Some observers have credited them with carrying small pebbles to their nests, but as these are not always found where the

eggs are laid, their presence may be due to some extent to accidental accumulation. When a bird leaves the nest, the mate at once pursues, as though trying to drive her back, chasing her along the ground, with upraised wings, meanwhile making the usual hissing noise, and following her even out to sea.

Upon each side of the abdomen of the specimens which I have examined are bare spots against which the eggs are held.

Although noisy at most times, they are invariably silent while sitting, differing markedly from the puffins in this respect. In no place were two birds found occupying the same cavity. If their eggs are taken, they will lay again in the same place.

Their food consists principally of fish, which they obtain by their expert diving.

Egg laying begins early in May and continues into July. Young in down were found July 16th, 1886.

Twenty-five sets of two eggs each average 61.6×41.4 mm. Selected specimens of the two extremes in size measure 66.5×41.5 ; 66×42 ; 64×43 ; 60×43 ; 60×39.5 ; 59.5×39.5 ; 58.5×41.5 ; 58.5×41 millimeters.

4. *Uria troile californica*.

CALIFORNIA MURRE.—By far the most abundant species, outnumbering all others combined. They begin to arrive on the island in myriad numbers by the first of April, and commence departing about the middle of September; by the first of October they have all left the island but can be seen upon the water.

Their arrival usually occurs at night when great numbers come suddenly, and perhaps leave the next day; especially are they likely to leave soon after coming—and before mating—if a storm occurs, returning of course later.

The food of the murre consisted, as far as was learned, wholly of fish.

When on the wing the murre sometimes makes a peculiar grunting sound; on the rocks they are very noisy, bowing their heads continually. They are much more clamorous and make greater demonstrations when they are joined by others, and like all the island sea fowls, are more so before a storm.

Distributed over the entire island and also the isolated rocks, and North and Middle Farallones, but in places much more abundant than in others; these densely populated rookeries are the ones worked by the eggers, who, during three months of the year, send the eggs of the murre and western gull to the San Francisco market, where they find a sale at from twelve to twenty cents a dozen.

Between 1850 and 1856 there was reported to have been brought to San Francisco between three and four millions of eggs. For the last few years the number of eggs marketed has averaged from one hundred and eighty thousand to two hundred and twenty-eight thousand. In 1886, two men who were left on Sugar Loaf collected one hundred and eight thousand eggs.

The South Farallon being the principal island, and the only one inhabited, is the one from which, with neighboring islets, the entire egg crop is harvested—most of the eggs coming from the Great Rookery at West End. The business is carried on by twelve to fifteen men, who inspect the rookeries occasionally to learn when the murres have commenced laying, as the time varies with different seasons. When ready to begin picking, all the eggs that can be reached are broken, so as to insure only fresh ones being taken, for the eggers maintain that an egg sat upon for a day is unfit to market; the gulls willingly assist in this destroying work. The entire main island, or rather those parts of it which are picked, is gone over every other day. In the forenoon of the first day they take the West End, commencing with Main Top, going out Great Rookery and to Indian Head, then across the flat to Murre Bridge. In

the afternoon, if not too tired, they collect on Seal Rock; but if this is omitted, all the eggs there must be destroyed, and a fresh lot laid, before any can be saved for market. The second day's picking will be made on the main part of the island, including all the rookeries at East End, also on the North Rocks and Sugar Loaf. Picking usually commences on Sugar Loaf, an isolated rock 185 feet high. It is warmer there, and more protected from prevailing winds, and, being less disturbed than the main rookeries, the murre lay there first. This rock is reached by means of a boat, which is left in charge of one man, while four or five others begin gathering, working from below upwards. Another man starts at once to the top and collects there, meanwhile keeping the gulls away. The boat seldom reaches the Sugar Loaf unnoticed by the gulls; but when it does occur, the first to make the discovery raises the cry, when all the gulls in the vicinity rise screaming, and follow the men—hovering, screaming and cackling over them. The Sugar Loaf is the most difficult place to collect eggs. In several places ropes are made fast to enable the eggers to reach the most inaccessible places. Two men have lost their lives on this rock: one of them fell, last year, into the sea and was never found. He had injudiciously stowed too many eggs in the front of his shirt, and in passing a narrow shelf the eggs actually crowded him off. Minor accidents and mishaps are of almost daily occurrence. One egger, having about ten dozen eggs in his shirt, fell and rolled a distance of twenty feet; although uninjured, he was completely soaked with egg. As a rule, the eggers get considerably spattered by the excrement from the birds whirling overhead.

Before proceeding further it will be well to notice closely the men who engage in this nest robbing extraordinary, and the methods they employ. The eggers are Italians and Greeks, usually those who have been engaged in fishing

about the islands; the first party to take possession each year manages to hold their position against all comers and to even defy the United States authorities to remove them. Being trespassers, they have, on more than one occasion, been taken away, but only to return the following year. This season the party secreted themselves in Murre Cave while the revenue cutter *Corwin* hovered about the island for hours. Living in caves or tents improvised from old sails and spars their requirements of life are few. A cotton flour sack (100 lb. size) is made into an egg shirt by cutting out a hole in the bottom for the head and one on each side for arm holes; a gathering string is passed around the mouth of the sack which, when it is put on, is drawn tightly about the waist; a slit down the front of the shirt from the neck makes an opening for stowing the eggs, while a padding of Farallon weed inside on the bottom forms a cushion for them.

Arriving on the picking ground or in a murre cave, they set to work, using both hands when possible. The birds take wing by pitching from their narrow shelves or scramble pell-mell out of the cave past the eggers. Eighteen to twenty dozen murre's eggs is considered a good load for a shirt, and about as heavy and bulky a load as a man will care to pack. Having filled the shirt the eggs are emptied into a basket to be carried to the landing. If overtaken by night, the eggs are dumped into a pile until the next day. The baskets filled with eggs, or the heaps which sometimes contain as many as one hundred and fifty to three hundred dozen, are most carefully covered with old sacks or weeds and weighted with rocks to prevent the gulls from getting at the contents. A few of these persistent thieves invariably hang around the egg heaps and baskets, and if an opening is espied revealing to sight an egg, they pull and tug at the weeds or sacks till the egg is obtained, when the lucky bird flies away with it, followed by others whose screams soon attract a large congregation about the eggs, which in an incredibly short space of time are all taken.

When sending the eggs to San Francisco, they are simply tumbled into the fishing boat; many are thereby dented or slightly cracked, but they are seldom broken enough to injure their market value. At San Francisco they are boxed and taken to market.

The single large egg laid by the murre is deposited at any place upon the rocks furnishing space enough for the bird to sit. Its pear shape, an all-wise provision no doubt, preventing it from rolling off of a slightly inclined plane. The egg is constantly guarded by one of the pair, for if left exposed it would be at once carried away by some watchful gull. Sometimes two or three gulls will combine to rob a murre that is separated a little from the colony; by feints and tormenting from all sides the murre, in an unguarded moment, or when striking at a gull, is certain to expose the egg, which is immediately snatched by one of the gulls, who, flying away, is pursued by the others for a share of the spoil, which they seldom get. The gull in possession of the egg retires to a convenient spot and breaks the egg, not by dropping it, for by that he would lose the contents, but by rolling it around against the rocks till it is dented sufficiently for the gull to insert his beak.

The gulls pick murre's eggs up bodily, and carry them away in their capacious mouths, but do not stick their bills into them to get hold, as stated by some writers, whose observations must have referred to eggs already broken by the gulls or eggers.

When the young is hatched the parents must be ever as watchful, for the gulls will steal a young murre as soon as they would an egg, and will swallow as large a young as they can get down their insatiable throats.

As soon as the young can care for themselves, that is, after the pin feathers are started, the murre's leave the island, or if the gulls are particularly numerous or troublesome, old birds, in order to save their young, crowd them from the rocks down and into the ocean where by diving they can

escape the gulls. If the young when crowded off a shelf by the parent falls upon another rock it is quickly followed by the old bird, who broods over it until another opportunity and another shove launches the young one in the water.

The parents share equally the duties of incubation, one remaining on the egg during the day the other by night. During the day few are seen flying unless disturbed by the eggers or the report of a gun, but when the relief is made morning and night they are especially noisy, quarreling and screaming in great masses of bird life.

The young sea lions have a great fondness for murre's eggs, and as soon as they are large enough to know what an egg is, and once get the taste of them, they become another factor in the destruction of eggs. Mr. Emerson has seen young sea lions with their muzzles slabbered with egg. The old sea lions do not trouble the rookeries, but spend their time ashore basking about the water's edge.

The island mule has also found that eggs make an agreeable variation to his diet. He hunts nests very assiduously, growing fat and sleek in the breeding season.

The large series of eggs of this species in Mr. Emerson's collection exhibits a wide range of variation in coloring, they being specimens selected from thousands. In size, fifty ordinary sized eggs average 82.9×50.8 mm. The following measurements show the extremes of normal specimens which were examined, 92×53 ; 91×51 ; 85×54 ; 85×63 ; 79×47 ; 77×47 ; 75×49 ; 75×50.5 millimeters.

Some diminutive eggs, and those noticeably of different shape or size, measured 95×46 ; 87×45 ; 77×48 ; 73×46.5 ; 68×44.5 ; 63.5×37 ; 60×38.5 millimeters.

5. *Larus glaucescens*.

GLAUCOUS-WINGED GULL.—A few were seen about the island as late as May.

6. *Larus occidentalis*.

WESTERN GULL.—This is the only gull which breeds on the Farallon Islands, and eggs of other species, such as California gull and American herring gull, purporting to have been collected there, have undoubtedly been wrongly identified. In numbers the gulls rank about second during the summer. In winter they distribute themselves along the coast and into San Francisco Bay, congregating at the island by the first of April. The gulls are indiscriminate feeders; in addition to their usual articles of diet, they subsist largely upon eggs during the summer. They do not eat the eggs of their own species, nor do they trouble the cormorants after the murrens have commenced laying. Sea urchins, crabs, young murrens and rabbits, and fish stolen from the cormorants' nests are eaten. Not being quick enough to swoop upon the rabbits, they catch them by patient watching at their burrows, and will patiently try for fifteen minutes to swallow a squealing young rabbit, and finally fly away with the hind feet protruding. The dead bodies of murrens are also eaten; they detach pieces of flesh by backing away and dragging the body, meanwhile shaking their heads, till a piece breaks off. A young gull raised by Mrs. Rugg has returned to the island annually for four years; although not tame enough to take food from her hand, he comes to the house and picks up any scraps of cooked food thrown to him and flies away screaming. He will not take raw meat, and would not eat it when young. He does not appear for food oftener than once a day, and sometimes only once a week.

They nest in small colonies of ten pairs or less, either on low flats or the high points. Two weeks are occupied in the rebuilding of last year's nests; on many days they apparently do not work at all. Even after the first egg is laid they continue to carry fragments of dry Farallon weed to their nests. The first eggs of the season were taken May 9th, in 1885 and 1886, and May 13th, in 1887. The eggers

collect the gulls' eggs for the San Francisco market during the first four weeks of their laying, after which they give their whole attention to the murre.

Usually three eggs constitute a setting, but from repeated robbing often only two are laid. When more than one egg is found in a nest by the eggers they are destroyed on suspicion of having been incubated. Gulls' eggs are collected in the same way as the murre's, but having thinner shells fewer are carried for a load in the shirt or basket.

A young gull from the islands, apparently but a few days old, differs from the downy young described in "The Water Birds of North America" (Vol. II, p. 230), in having the abdomen and sides mottled, although the marks are not as clearly defined as those of the back and head.

The hundreds of gulls' eggs which I have seen vary considerably in intensity of color. The average size of fifty eggs, taken indiscriminately, was 70.2x49.4 mm. The largest and smallest measurements found in this series of fifty specimens were 76x51; 72x52; 72x48; 71x52; 71x46; 66x46; 65x48 millimeters.

7. *Larus californicus*.

CALIFORNIA GULL.—More or less common during the fall.

8. *Larus heermanni*.

HEERMANN'S GULL.—Occasionally seen by Mrs. Rugg.

9. *Diomedea albatrus*.

SHORT-TAILED ALBATROSS.—An adult male which I have not seen, but which has been identified by Mr. Emerson, is now in the possession of Mrs. Rugg. The bird followed a ship to the island and was shot by one of the men on a tow boat, March 20th, 1887.

10. *Oceanodroma homochroa*.

ASHY PETREL.—The last to arrive on the island is this small petrel, which is also the rarest of the birds which breed there.

They nest anywhere on the island in natural cavities, particularly those under loosely piled rocks. No nest is made and only a single egg laid, although it sometimes happens that an egg and downy young will be found in the same place. The egg of this petrel was first found by Mr. A. M. Ingersoll on the South Farallon, and noticed by him in the "Ornithologist and Oölogist," of February, 1886. The egg is accurately described as "dull creamy white in color, with a circle of reddish dottings so fine as to be almost indistinct, around the large end, which is somewhat flattened like the large end of an acorn." It measured 30x24 mm. (1.18x94 ins.) Two sets of petrels' eggs collected by Mr. Emerson, June 15th, 1885, and June 8th, 1886, measure respectively 30x23 and 31x23.5 millimeters.

A young bird which was taken from the nest June 11th, 1886, has a heavy covering of light slaty down on the underparts, across the interscapulars and on the head. With the exception of the parts mentioned the bird is feathered. The tips of wing coverts are light gray.

11. *Phalacrocorax dilophus albociliatus*.

FARALLON CORMORANT.—Although not the most abundant of the cormorants they gather in the largest rookeries for nesting. About the first of May this species begins to collect dry kelp and stalks of the Farallon weed, which they carry in large mouthfuls to their rookery, usually on some rough ridge side. They are very dilatory in the work of construction, resting a great deal upon the nest, whereby a depression is formed on the accumulated material, for the eggs. By May 10th some of the nests contain eggs, and a week later every nest is covered by a sitting bird; both sexes share the work of incubation, one staying on the nest while the other is off fishing.

While sitting the birds purloin material from each other's nests to add to their own.

They will lay repeatedly in the same nest if robbed.

Being the tamest of the cormorants, their nests can be approached within a few feet before the birds reluctantly crawl off, and if no further advance is made, they crawl awkwardly back upon the eggs, knowing that the gulls will take them at once if deserted. If frightened by the too close approach of any one or the report a gun they take wing, but soon return. The flight of the cormorants from their rookeries is spoken of by Mr. Emerson and others as a wonderful sight. The eggs of this species, fifty examples of which have been measured, average 60.7×39.5 mm. The most noticeable sizes are 64.5×38.5 ; 64×40.5 ; 63.5×41 ; 63×41 ; 57×38 ; 56.5×38 millimeters.

12. *Phalacrocorax penicillatus*.

BRANDT'S CORMORANT.—They commence laying about the same time as the Farallon cormorant, selecting places rather accessible to an oölogist, where they congregate in large rookeries, principally at West End and Sugar Loaf. Like the other species they often have great difficulty in getting a nest built, as the thieving gulls will carry away the weeds about as fast as they can gather them. The eggs are usually four, sometimes five or even three in number, and vary somewhat in shape as well as size. Some eggs are rather oblong and pointed at the ends, others shorter and blunt at one or both ends—characters which are noticed in all the cormorants' eggs from the island, there being no rule of shape to guide one in identifying the species.

Eleven sets of four eggs and two sets of three give an average size of 62.5×38.5 mm.

Special measurements of eight examples to show the extreme variations offer the following results, 66.5×38 ; 66×37.5 ; 65×36 ; 64×40 ; 61.5×37 ; 59.5×41 ; 57.5×40 ; 56×38 millimeters.

The young are hatched entirely naked, their skin resembling a greasy, black kid glove in appearance. In this condition, and even after the down is on them, they are irresistible.

ble morsels to the hungry gulls. The young are abundantly supplied with small fish, which may be seen lying in and about the nests.

13. *Phalacrocorax pelagicus resplendens*.

BAIRD'S CORMORANT.—They are less common than the two foregoing species, with which they do not associate. The nests are built usually in the most inaccessible places, and at all altitudes; some were found so close to the water's edge that they were splashed by the highest waves beating against the rocky shore. The same rookeries are used from year to year, and the same nests are occupied after being robbed, the owners simply adding a few more pieces of weeds before laying. They congregate in colonies of eight or ten pairs, nesting on natural shelves of perpendicular or overhanging rocks. Three or four eggs are laid in a nest of the same material as is used by the other cormorants. Incubation commences after the first egg is laid, in order to keep it protected from the gulls. The birds may be seen on the nests for days before the first egg is laid.

The eggs of Baird's cormorant may usually be known by their small size, the average dimensions of thirty-six specimens (nine sets of four), are 55.5×36.5 mm. By the following examples it will be seen that the largest ones are nearly or quite the size of some of the smallest eggs of the other two cormorants, 59×27 ; 59×36 ; 58×38 ; 58×37.5 ; 54×35 ; 53×35 ; 52×36 ; 52×35 .

The young are bare when hatched, and do not appear with down until they are, as Mr. Emerson judged, about three weeks old.

14. *Pelecanus californicus*.

CALIFORNIA BROWN PELICAN.—Seven were seen on the rocks one morning.

15. *Fregata aquila*.

MAN-O'-WAR BIRD.—A skull of this was found by Gruber on the Island in 1861.

16. *Merganser serrator*.

RED BREASTED MERGANSER.—One bird was taken by Mrs. Rugg.

17. *Oidemia perspicillata*.

SURF SCOTER.—A few seen feeding near the island.

18. *Plegadis guarauna*.

WHITE-FACED GLOSSY IBIS.—One bird was shot in the spring of 1884, from a flock of half a dozen.

19. *Ardea herodias*.

GREAT BLUE HERON.—A few are seen on the island every winter.

20. *Ardea candidissima*.

SNOWY HERON.—They have been noticed only on one occasion, when three were seen.

21. *Rallus obsoletus*.

CALIFORNIA CLAPPER RAIL.—A female bird was shot November 18th, 1886.

22. *Porzana jamaicensis coturniculus*.

FARALLON RAIL.—Regarding the claim of the unique specimen of this bird as a valid variety, there does not appear to be sufficient grounds for its retention as a separate form. In the light of Mr. Emerson's investigations, and that of others who have visited the islands and found no rails or suitable places for them to live, there seems to be but one conclusion to draw concerning it, and that is that it is an abnormal specimen of *P. jamaicensis*.

23. *Fulica americana*.

AMERICAN COOT.—One was caught alive in the spring of 1884, and kept in a coop for several days before it was al-

lowed to go. They are very common on the water about the island during the fall.

24. Phalaropus lobatus.

NORTHERN PHALAROPE.—They have been seen in the fall.

25. Tringa minutilla.

LEAST SANDPIPER.—This species occurs in flocks on the island, and doubtless *Ereunetes occidentalis* does also, but specimens were not obtained.

26. Tringa alpina pacifica.

RED-BACKED SANDPIPER.—Seen in flocks in the fall.

27. Heteractitis incanus.

WANDERING TATTLER.—Several were seen every day in May, 1886, associated with the black turnstone. More were observed in June, 1885. They would not follow the turnstones inland, but remained at the water's edge. When flushed they rose with a short, shrill whistling note, and made a long flight before alighting. They appeared to be extremely shy at all times.

At high tide they sat motionless upon the rocks, which they resembled in color, making it difficult to detect them unless flushed. When the tide was out they fed at the water's edge; following a receding wave they searched hurriedly amongst the kelp for food, running or making short flights to escape an incoming breaker. Several times a laggard was overtaken and covered by a breaker; when it receded he flew to the rocks and after shaking the water from his plumage, returned to feed. A male was taken July 22d, 1886, and a female later the same month (27th.)

28. Numenius longirostris.

LONG-BILLED CURLEW.—Stragglers occur during migration.

29. *Ægialitis vocifera*.

KILLDEER.—Common at times during the fall.

30. *Arenaria interpres*.

TURNSTONE.—An adult male taken by Mr. Emerson, May 7th, 1887.

31. *Arenaria melanocephala*.

BLACK TURNSTONE.—Flocks of five to ten were seen in May and June, 1887. They were very tame, feeding slowly and quietly along the water's edge in compact flocks. Upon higher ground they moved more rapidly and spread out more. Individuals were seen as late as August, but they do not, Mr. Emerson states, breed on the island. A female was taken July 26th, 1886.

32. *Columba fasciata*.

BAND-TAILED PIGEON.—A single bird came March 25th, 1886, and stayed for a day, seeming very tired. A number of pigeons visited the island in the winter of 1884-5.

33. *Zenaidura macroura*.

MOURNING DOVE.—As many as nine of these birds have been seen in a single day. Mr. Emerson observed five May 25th, 1887. Single birds were seen at different times during the same month, and in August, 1887.

34. *Elanus leucurus*.

WHITE-TAILED KITE.—Several seen by Mrs Rugg in the winter of 1886-7.

35. *Accipiter cooperi*.

COOPER'S HAWK.—A specimen taken in 1886.

36. *Circus hudsonius*.

MARSH HAWK.—One seen in May, 1885.

37. *Buteo borealis calurus*.

WESTERN RED-TAIL.—Every spring the island is visited by numbers of these hawks. In 1882 they came in April, about the time of the arrival of the murre, leaving again in May. During their short stay they fed almost exclusively upon the murre, killing, in the estimation of Mr. Emerson, several dozen a day. In 1887 the lighthouse men killed about seventeen of these hawks, and during the month of May, 1885, twenty-eight, mostly of this species, were destroyed.

38. *Archibuteo ferrugineus*.

FERRUGINEOUS ROUGH-LEG.—One specimen killed.

39. *Falco mexicanus*.

PRAIRIE FALCON.—An adult male taken December 18th, 1886.

40. *Falco peregrinus anatum*.

DUCK HAWK.—A specimen was shot December 15th, 1886.

41. *Pandion haliaetus carolinensis*.

AMERICAN OSPREY.—One was shot December 15th, 1886; no others have been seen since.

42. *Asio accipitrinus*.

SHORT-EARED OWL.—One was seen in the spring of 1885 and one in May, 1887, by Mr. Emerson.

43. *Speotyto cunicularia hypogæa*.

BURROWING OWL.—Two were seen in the spring of 1887, sitting on the rocks.

44. *Ceryle alcyon*.

BELTED KINGFISHER.—One was seen August 16th, 1887.

45. *Colaptes cafer*.

RED-SHAFTED FLICKER.—Occasionally seen in the winter.

A specimen, yellow on under surface of wings and tail and with red cheek-patches, is in the collection of Mrs. Rugg.

46. *Trochilus anna*.

ANNA'S HUMMING-BIRD.—A single bird has been seen at the island.

47. *Trochilus*.

Humming-birds, supposed to be either *rufus* or *alleni*, have been seen in the spring, and also on August 15th, 1886.

48. *Tyrannus verticalis*.

ARKANSAS KINGBIRD.—Seen May 28th, 1887.

49. *Contopus richardsonii*.

WESTERN WOOD PEWEE.—Seen on a number of different days during the month of May, 1887.

50. *Empidonax difficilis*.

BAIRD'S FLY-CATCHER.—One specimen was taken by Mrs. Rugg.

51. *Corvus corax sinuatus*.

AMERICAN RAVEN.—Old nests of this bird are mentioned by a visitor to the island as having been shown him by the light-keeper. As they are known to build among the rocks in the Santa Barbara Islands, the reference is probably correct.

52. *Corvus americanus*.

AMERICAN CROW.—One pair seen during visit of May, 1887; two pairs in June, 1885.

53. *Agelaius phoeniceus*.

RED-WINGED BLACKBIRD.—A fall visitor.

54. *Sturnella magna neglecta*.

WESTERN MEADOW-LARK. — Stragglers come during the winter.

55. *Scolecophagus cyanocephalus*.

BREWER'S BLACKBIRD.—The shyest of the straggling land birds that visit the island. They appear in large flocks during the winter.

56. *Carpodacus frontalis rhodocolpus*.

CRIMSON HOUSE FINCH.—They occur at times during the winter. A young of the year was seen by Mr. Emerson May 26th, 1887.

57. *Spinus psaltria*.

ARKANSAS GOLD-FINCH.—Small flocks appear at intervals during the winter; they feed on the seed of the Farallon weed, and often remain on the island for several days.

58. *Zonotrichia gambeli*.

GAMBEL'S SPARROW.—This and the next following species visit the islands in flocks.

59. *Zonotrichia coronata*.

GOLDEN-CROWNED SPARROW.—An immature female taken September 16th, 1886, on which day large numbers of this species were seen.

60. *Spizella socialis arizonæ*.

WESTERN CHIPPING SPARROW.—One seen May 22d, 1887.

61. *Junco hyemalis oregonus*.

OREGON JUNCO.—Have been frequently seen in large flocks during the winter.

62. *Habia melanocephala*.

BLACK-HEADED GROSBEEK.—Two birds have been seen; one was taken May 28th, 1887.

63. *Piranga ludoviciana*.

LOUISIANA TANAGER.—A male in immature plumage was

taken from a flock of nearly a dozen, on September 13th, 1886.

64. *Chelidon erythrogaster*.

BARN SWALLOW.—A pair came to the islands on May 21st, 1887, and after vainly trying to find mud for a nest, departed on June 2d.

65. *Lanius ludovicianus excubitorides*.

WHITE-RUMPED SHRIKE.—One seen on the island for several days in 1886.

66. *Vireo bellii pusillus*.

LEAST VIREO.—Two male specimens, one of which was caught alive in the house on May 28th, 1887, are in Mr. Emerson's collection.

67. *Mniotilta varia*.

BLACK AND WHITE WARBLER.—A male in good plumage was found on the rocks below the bell wires that lead to the tower May 28th, 1887; it is now in Mr. Emerson's collection. It measures, wing, 68 mm.; tail feathers, 50 mm.; bill from nostril, 8.5 mm.; tarsus, 16 mm.; middle toe and claw, 15.5 mm.

68. *Helminthophila celata lutescens*.

LUTESCENT WARBLER.—One was seen in company with other small land birds on May 22d, 1887.

69. *Dendroica æstiva marcomi*.

WESTERN YELLOW WARBLER.—Two seen May 22d, 1887.

70. *Dendroica cærulescens*.

BLACK-THROATED BLUE WARBLER.—A female of this species remained in and about the house for three weeks, dying November 17, 1886. It is believed to be the first occurrence of this warbler in California, for it has never been observed

on the mainland. It measures, wing, 59.5 mm.; tail feathers, 49 mm.; bill from nostril, 7 mm.; tarsus, 18 mm.

71. *Dendroica townsendi*.

TOWNSEND'S WARBLER.—Two males were seen on May 22d, 1887.

72. *Sylvania pusilla pileolata*.

PILEOLATED WARBLER.—Immature male taken September 12th, 1886. A female seen May 22d, 1887.

73. *Galeoscoptes carolinensis*.

CATBIRD.—The occurrence of this bird on the South Farallon has been noted by Mr. C. H. Townsend, who secured a specimen on September 4, 1884.

74. *Salpinctes obsoletus*.

ROCK WREN.—Mr. Emerson found this species to be quite common on the island, and it is the only land bird which is resident. They were found all over the South Farallon, but more numerous about the southern exposure of the lighthouse hill. They build in suitable crevices a nest of Farallon weed, lining it with chicken feathers and hair shed from the island mule. About the entrance they accumulate small bits of rock, coal, mussel shells, and small bones from dead sea-birds and rabbits. Nests containing eggs were found on the 5th of April, 1886, and on June 16th, 1885. Five and six eggs constitute an average set, but one nest was found with ten eggs, two of which were fresh, and the others in various stages of incubation.

As well as can be judged from the specimens at hand, which are in worn plumage, the island rock wrens are identically the same as those from various localities in California. The average measurements of five males, taken in May, 1887, give the following results:

Wing, 72.5 mm.; tail feathers, 55.1 mm.; bill, from nostril, 14.3 mm.; tarsus, 20.4 mm.; middle toe, 14.8 mm.

Three females, shot at the same time, average:

Wing, 70 mm.; tail feathers, 52 mm.; bill, from nostril, 13.8 mm.; tarsus, 20.6 mm.; middle toe, 15 mm.

75. *Sitta canadensis*.

RED-BREASTED NUTHATCH.—A number were seen in September, 1885, and a single female secured for identification.

76. *Regulus calendula*.

RUBY-CROWNED KINGLET.—A single specimen was taken and prepared by Mrs. Rugg.

77. *Turdus aonalaschkæ*.

DWARF HERMIT THRUSH.—One specimen seen by Mrs. Rugg in the winter of 1886-7.

78. *Merula migratoria propinqua*.

WESTERN ROBIN.—Stragglers are occasionally seen during the winter.

79. *Hesperocichla nævia*.

VARIED THRUSH.—Several came to the island in the winter of 1886-7, and a specimen was secured.

80. *Sialia mexicana*.

WESTERN BLUEBIRD.—A few seen occasionally.

81. *Sialia arctica*.

MOUNTAIN BLUEBIRD.—They appear in flocks in the winter time, but remain only a few days.

*A List of the American Species of Gobiidæ and Callionymidæ,
with Notes on the Specimens Contained in the Museum of
Comparative Zoölogy, at Cambridge, Massachusetts.*

By CARL H. EIGENMANN and ROSA SMITH EIGENMANN.

In the Proceedings of the United States National Museum, 1886, pp. 477-518, Jordan & Eigenmann have given descriptions and the synonymy of the species of Gobiidæ of North America. In this paper we give descriptions of all American forms not mentioned by Jordan & Eigenmann. The nomenclature has been corrected, and the following forms described as new: 1, *Gobius lucretiæ*; 2, *Gobius garmani*; 3, *Gobius hemigymnus*; 4, *Microgobius eulepis*; 5, *Barbulifer papillosus*, gen. et spec. nov.; 6, *Clevelandia longipinnis*, gen. nov.; 7, *Callionymus calliurus*.

We wish to express our thanks to Dr. Alexander Agassiz, Curator of the Museum, and to Mr. Samuel Garman, for the privilege of studying the American Fishes contained in the collection of the Museum of Comparative Zoölogy.

Family GOBIIDÆ.

Sub-family OXYMETOPONTINÆ.

I. IOGLOSSUS Bean.

1. *Ioglossus calliurus* Bean. Gulf Coast of the United States.

Sub-family ELEOTRIDINÆ.

II. GOBIOMORUS Lacépède.

2. *Gobiomorus lateralis* (Gill). Panama.

Nos. 13,430 and 13,431, three specimens. Cape St. Lucas, Xantus.

The specimens have a broad lateral band and a large distinct spot on base of caudal.

3. *Gobiomorus dormitor* Lacépède.

Eleotris longiceps Günther, Proc. Zool. Soc. Lond., 1864, 151 (Lake Nicaragua).

West Indian Fauna, East Coast of Central America and Surinam.

The specimens in the Museum are from St. Thomas, Surinam, Barbadoes, Fort de France, Martinique, St. Lucia, Hayti, and Lake Nicaragua.

The largest specimen is a head from Hayti, which measures $5\frac{3}{4}$ inches from tip of lower jaw to end of opercle.

The color in adult individuals varies from light brown to blue black. The young somewhat like *Gobiomorus lateralis* in general coloring; having profuse dark markings, the belly plain; an interrupted black bar on middle of sides; no regular spot at base of tail.

A specimen collected in Lake Nicaragua by Frœbel is presumably to be referred to *Eleotris longiceps* Günther, but no tangible differences can be detected between it and specimens of *Gobiomorus dormitor* from other localities.

A comparison of the species *G. lateralis* and *G. dormitor* shows them to be very closely related. We append the differences observed:

<i>lateralis.</i>	<i>dormitor.</i>
Scales in median series uniformly, 52.	Scales in median series, 55—57.
In a cross series, 17.	In a cross series, 18—22.
Scales from nape to first dorsal spine, 27.	Scales from nape to first dorsal spine, 27—34.
Head in length, $2\frac{4}{5}$ —3.	Head in length, $3-3\frac{1}{2}$.
Depth, 5—6.	Depth, $5\frac{1}{2}$ —6.
Dorsal vi—10.	Dorsal vi—10.
Anal 11.	Anal 10.

4. *Gobiomorus maculatus* (Günther) Ecuador.

III. DORMITATOR Gill.

5. *Dormitator maculatus* (Bloch).

Eleotris latifrons Richards. Voy. Sulph. Fishes 57, plate 35, figs. 4-5, 1837. *Dormitator microphthalmus* Gill, Proc. Acad. Nat. Sci. Phila. 1863. 170.

West Indian fauna from South Carolina to Para; Panama.

The specimens in the Museum are from Charleston, S. C., Mobile Bay, Barbadoes, Sao Matheos, Cuba, Hayti, Porto Rico, St. Thomas, Martinique, Pará, Gurupa and mouth of Rio Grande.

Specimens $1\frac{1}{2}$ inches long, collected by Mr. Samuel Garman at Martinique, have interrupted cross bars of light and dark. Numerous specimens of the same length from canals in Para have similar, but fainter, markings; while many of them have longitudinal lines formed by the occurrence of a black spot on the centre of each scale.

There seem to be two forms of the adult—one with the profile gibbous, the dorsal outline forming a regular curve; the other having the profile depressed over the eyes, the anterior portion being sub-horizontal. The specimens from Gurupa and the Rio Grande have the profile depressed; all the other specimens have a gibbous profile.

A comparison in detail of the two forms is appended. Only extreme differences are given.

West Indian specimens, 5 — $7\frac{1}{2}$ inches.

Profile regularly curved from first dorsal spine to snout.

Head $3\frac{1}{2}$ to 4; depth 3 to $3\frac{1}{2}$; depth always greater than length of head.

Highest anal ray $1\frac{1}{6}$ to $1\frac{2}{3}$ in head.

Distance from first dorsal spine to snout greater than distance from first dorsal spine to first anal ray.

Scales in median series 29 to 32.

Color usually dark brown, a black spot above base of pectoral, a short bar on base of pectoral.

Rio Grande specimens, 5, $6\frac{1}{4}$ and $7\frac{1}{4}$ inches.

Profile depressed over eye, becoming horizontal anteriorly.

Head 3; depth 3 to $3\frac{1}{4}$; depth usually less than length of head.

Highest anal ray $1\frac{2}{3}$ to 2 in head.

Distance from first dorsal spine to snout equals distance from first dorsal spine to base of last anal ray.

Scales in median series 30 to 34.

Color gray, a jet black spot above base of pectoral; a black bar at base of pectoral; a black line from eye to mouth; longitudinal black lines on cheeks and opercles; dark spots on back; some silvery scales on sides.

Dr. Jordan's description of the types of *Eleotris grandisquama* agrees well with the specimens of *Dormitator mac-*

ulatus from the Rio Grande. If it is identical with them the species *grandisquama* cannot be separated from *maculatus*.

The characters given by Eigenmann & Fordice* to distinguish *maculatus* from the Pacific Coast species, *latifrons*, are not of specific value. The numerous specimens of *maculatus* examined by us differ in every character more than *maculatus* is said to differ from *latifrons*. Thus the number of scales between the ventral and the vent differs from 12 to 20 in specimens of *maculatus* which we have examined.

6. *Dormitator grandisquama* (Cuv. & Val.). America.

Probably another synonym of the preceding.

IV. GUAVINA Bleeker.

7. *Guavina guavina* (Cuv. & Val.)

West Indian fauna, south to Rio de Janeiro.

The specimens in the Museum are from Ceara, Victoria, Sao Matheos, Cuba, Rio Janeiro, Rio Grande do Sul, Turbo, Atlantic Coast of Central America, Barbadoes, Goyaz, Brazil.

8. *Guavina brasiliensis* (Sauvage). Brazil.

Eleotris (*Eleotris*) *brasiliensis* Sauvage, Bull. Soc. Philom., Paris. Series 7, IV, 53; 1880.
(Bahia.)

Depth $6\frac{1}{2}$ in total length; head $4\frac{2}{3}$. D. VII—I, 9; A. I, 9; Scales, 80.

Snout equal to eye, 5 in head; 2 in interocular space. Lower jaw a little produced, maxillary to below anterior third of eye. Teeth of outer series enlarged. Preopercle without spines. Scales small, ciliated, 35 series between origin of second dorsal and anal. Scales on top of head as large as those of body, and reaching to tip of snout.

Uniform brown; length 0.115 m.

* Proc. Philad. Acad. Nat. Sci., 1885, 71.

V. ELEOTRIS Gronow.

9. *Eleotris amblyopsis* Cope.

Surinam; Atlantic and Gulf coast of the United States.

We have examined fifteen specimens, $2\frac{1}{2}$ inches or less in length, all from Surinam. The scales in a median series vary in these specimens from 40 to 44; in a transverse series between second dorsal and anal, from 12 to 14. These are the only characters which separate this species from *E. pisonis* (Gmelin).

The American species of *Eleotris* may be distinguished as follows:

- a. Teeth sub-equal, those of the inner or outer series enlarged.
- b. Cheek entirely scaled.
- c. Teeth of the inner series of both jaws enlarged.
- d. Scales in a median series 40 to 44; in a cross series 12 to 14.
- dd. Scales in a median series 57 to 66; in a cross series 18 to 20.
- cc. Teeth of the outer series enlarged.....
- bb. Lower half of cheeks naked.....
- aa. Teeth all equal.....

amblyopsis, 1.

pisonis, 2.

beliziana, 3.

perniger, 4.

æquidens 5.

10. *Eleotris pisonis* (Gmelin).

West Indian fauna; Florida to Rio de Janeiro.

The specimens in the Museum are from Tajaperu, Para, Cuba, Rio de Janeiro, Victoria, Rio Doce, Nazareth, Pernambuco, Ft. de France, Martinique, St. Vincent, Dominica, St. Kitts, Hayti, Florida.

There is considerable variation among the specimens; the young have narrow longitudinal lines, and lines radiating from the eye; the teeth of the inner series are enlarged—more in young, less in adult specimens.

11. *Eleotris perniger* Cope.

West Indian fauna south to Rio de Janeiro.

12. *Eleotris beliziana* Sauvage.

Atlantic Coast of Central America.

13. *Eleotris æquidens* (Jordan & Gilbert). Panama.

VI. EROTELIS Poey.

14. *Erotelis smaragdus* (Cuv. & Val.).
West Indian fauna; Key West.

VII. GYMNELEOTRIS Bleeker.

15. *Gymneleotris seminuda* (Günther). Panama.

Sub-family GOBIINÆ.

VIII. SICYDIUM Cuv. & Val.

16. *Sicydium plumieri* (Bloch). West Indian fauna.

The specimens in the Museum are from Hayti, Dominica, Martinique, Cuba (Poey's types of *siragus*), St. Vincent.

Mr. Samuel Garman collected several hundred specimens of this species at Kingston, St. Vincent. Most of these specimens are less than an inch in length, the longest $1\frac{1}{4}$ inches; they differ considerably in coloration from the adult; most are entirely naked, a few of those examined having scales only on the posterior part of the body. Caudal deeply emarginate. There are traces of about seven dark vertical bars; a black bar at base of pectoral; dorsals with several series of black spots; an H-shaped figure on base of caudal, a black bar on the posterior half of caudal fin; belly and lower part of body plain; everywhere else with black points. The specimens collected by Mr. Garman may be the types of a new species. No large specimens were collected at the Island of St. Vincent.

Specimens an inch and a half in length from Hayti have the fins plain and a series of blotches along the middle of the posterior part of the body; the body, except the belly, is entirely covered with scales which are plainly ctenoid.

IX. SICYPTERUS Gill.

17. *Sicypterus gymnogaster* (Grant). Panama.
18. *Sicypterus salvini* (Grant). Panama.

X. EVORTHODUS Gill.

19. *Evorthodus breviceps* Gill. West Indian fauna.

XI. LOPHOGOBIUS Gill.

20. *Lophogobius cyprinoides* (Pallas). West Indian fauna.

XII. GOBIUS Linnæus.

21. *Gobius lucretiæ* spec. nov.

No. 3957, one specimen, $1\frac{3}{4}$ inches. Pearl Island, Gulf of Panama.

Head $3\frac{1}{2}$ in length ($4\frac{3}{4}$ in total); depth $5\frac{1}{3}$ (7); D. VII-10; A. 12. Scales, in a median series, about 28; in a cross series, 8.

Body slightly compressed posteriorly; head little wider than high; eye placed high, its diameter equal to length of snout, $4\frac{1}{2}$ in head; profile little decurved; mouth large, oblique, maxillary extending below posterior margin of orbit, 2 in head; intermaxillary anteriorly on a level with the centre of the pupil; teeth all recurved, large, those of the upper jaw in a narrow band, the teeth of outer and inner series enlarged, those of the lower jaw similar, largest in front. No dermal flaps on shoulder-girdle. Scales large, very weakly ctenoid; becoming cycloid and very much crowded above and below pectoral; head, breast and anterior part of nape naked. As seen through a lens, these regions seem to be covered with minute, imbedded scales: this effect is, no doubt, due to light reticulations on a darker ground.

Dorsal spines slender, not filamentous; caudal pointed, 3 in length of body; ventrals $1\frac{1}{4}$ in head; pectorals longer than head.

Color light brownish, with four oblique, dark cross bars as wide as the interspaces; four narrower transverse bars on nape and back; a large dusky spot at base of caudal; upper

half of base of pectoral black; a black spot on opercle, margined below and behind with silvery; fins dusky.

We have named this species for Mrs. Lucretia M. Smith, of San Diego, California.

This is the only American species of *Gobius* proper having 7 dorsal spines.

22. *Gobius soporator* Cuv. & Val. All tropical seas.

The specimens examined are from Panama, Barbadoes, Para, Itapua, Cuba, Galapagos, Sambara, Bahia, Orange Key, Bahamas, Pernambuco, St. Thomas, Tortugas, Florida Keys, Martinique, Sao Matheas, Curuca, Rio de Janeiro, Rio Doce.

The color variations among examples of this species are very great, specimens from one locality varying from plain sand color, or gray, to greenish black: some dark brown specimens have light bars across the back; in others the scales have light centers forming horizontal series of light lines; sometimes there are light spots on sides of head and cheek; some specimens are conspicuously marbled with light and dark brown; and white spots occur in the centres of some of the scales on specimens of any ground color, these white spots being brighter on some of the scales than on the others, forming interrupted longitudinal lines. If any value could be placed upon the coloration, almost every specimen would be a distinct species. The color variation is irrespective of locality, some localities having all the above described variations. The types of Poey's *mapo*, *lacertus* and *brunneus* prove to be color varieties of *Gobius soporator*.

We have compared these various forms of *soporator* with *Gobius albopunctatus* collected by Dr. Klunzinger in the Red Sea; with others collected by Mr. Garrett in the Society Islands, Sandwich Islands and Kingsmill Islands; with specimens collected by C. L. Salmin at Cape York, Australia, and with those collected by B. G. Snow on Ebon

Island, Marshall Group. We are not able to detect any specific differences. Some of the American specimens might readily be identified as *albopunctatus*, but, on account of the perfect intergradation of these specimens with the typical *soporators*, we prefer to refer all the specimens before us to the one species *soporator*, which seems therefore to be universally distributed in tropical seas.

23. *Gobius andrei* Sauvage. Ecuador.

Bull. Soc. Philom., Paris. Ser. 7, IV, 44; 1880.

Depth 6 in total length; head, 4. D. VI-I, 9; A. I, 7. Scales, 35 in a median, 12 in transverse series.

Head much wider than high; snout equal to diameter of eye, $4\frac{1}{2}$ in head; interorbital space narrower than eye; maxillary reaching below centre of eye. Teeth of outer series larger than the others; no canines. First dorsal not quite as high as body; caudal rounded; upper rays of pectoral silky; ventrals not to vent. Scales ciliated.

Uniform brown; lower part of spinous dorsal tinted with black; soft dorsal and anal with large brown spots; anal blackish. Length 0.160.

(Guayas, Ecuador.)

An examination of the type of this species will doubtless prove it to be a *soporator*.

24. *Gobius nicholsi* Bean. Californian fauna.

25. *Gobius glaucofrænum* (Gill). West Indian fauna.

There are four specimens of a *Gobius* in the collection labelled "No. 13,212, Tortugas, Lyman." They agree with Dr. Gill's description of *glaucofrænum*, which is said to be found on the coast of Washington Territory. Evidently a mistake has been made in the locality of the type or of the specimens in the Museum of Comparative Zoölogy, as it is not probable that this species occurs in the waters of Wash-

ington Territory and also in the Tortugas. As no Goby of this type was found on the Pacific Coast by Jordan & Gilbert or by Dr. Bean, in very thorough explorations of that region, it is likely that the locality originally assigned is an erroneous one.

The following is a description of the specimens from the Tortugas :

Length $1\frac{7}{8}$, $1\frac{7}{12}$, $1\frac{1}{3}$, $1\frac{1}{6}$ inches.

Head, $3\frac{4}{5}$ in length ($4\frac{3}{8}$ in total); depth, $4\frac{1}{2}$ ($5\frac{1}{2}$); D. VI—10; A. 10. Scales, in a median series, 23, in a transverse series, 8.

Eye as long as snout, $3\frac{1}{2}$ in head; jaws equal; maxillary barely reaching pupil; teeth in bands in both jaws, those of the outer row of the lower jaw enlarged.

Dorsal spines scarcely filamentous; the third highest and equal to depth of body; posterior dorsal rays highest, as high as spines. Anal similar to soft dorsal; pectoral long and narrow, longer than head, $3\frac{1}{2}$ in body; ventral reaching past vent. Scales large, thin, finely toothed, reduced on breast; nape naked.

Color in spirits, light yellowish-brown. A light spot on each scale, the spots especially conspicuous near shoulder; six dark spots on middle of back; fainter but similar spots along middle of sides; a conspicuous dark spot above opercle, a wavy light line extending forward from it through lower rim of eye to snout; a straight pale blue bar extending parallel to it across preopercle and cheek to corner of mouth; a narrow faint bar below it; a triangular dark spot at corner of mouth. Cheeks and preopercle purplish chocolate; opercle and snout plain yellowish; two brown spots at base of caudal. The smaller specimens differ from this in having the markings more distinct.

26. *Gobius quadriporus* Cuv. & Val. Surinam.

Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 87, 1837. (Surinam.)

D. VI—1, 9. A. 1, 9. Scales as in *G. caninus*.

The two pores on the vertical arm of the preopercle very open; two smaller ones above them; teeth of the outer series small, two small canines on each side of lower jaw; dorsal spines not prolonged as filaments; color yellowish, with lighter lines which follow the rows of scales; brown spots on dorsal; two lines on cheeks.

27. *Gobius stigmaturus* Goode & Bean.

West Indian fauna; Key West.

28. *Gobius shufeldti* Jordan & Eigenmann.

Gulf Coast of the United States.

29. *Gobius garmani* sp. nov.

The types of this species are:

No. 26,081, one specimen, $3\frac{1}{6}$ inches long; Dominica. S. Garman.No. 26,062, three specimens, 2 inches, $1\frac{3}{4}$ inches, and 1 inch; Fort de France, Martinique. S. Garman.No. 27,122, four specimens, 3 inches, $2\frac{1}{2}$ inches, $2\frac{5}{8}$ inches, and $2\frac{3}{4}$ inches; St. Kitts. S. Garman.

Head 4 in length ($5\frac{1}{2}$ in total); depth 4 ($5\frac{1}{2}$). D. VI—11;
A. 11. Scales in a median series 30, in a cross-series 7.

Body robust, head short and blunt; profile in front of eye abruptly decurved, rounded much as in *Gobius boleosoma*; mouth inferior, horizontal; lower jaw included; maxillary extending to below pupil, $2\frac{1}{2}$ in head; lips thin; teeth short and thick, in a single series in each jaw.

Dorsals contiguous; dorsal spines filamentous, the second and third longer than the rest, reaching past first third of second dorsal; last dorsal rays reaching base of caudal; pectorals equal to the head in length; ventral short and broad, 5 in body; caudal rather long and pointed, 3 in body. Scales large, slightly reduced and cycloid on nape.

Color yellowish, marbled with brown; a series of irregular

blotches along the sides; a light spot at base of caudal, partly or wholly surrounded by a broad ring of dark brown; head slate color, white below; three dark bars extending forward and downward from eye to mouth, a triangular spot on opercle; dorsals, caudal, and pectorals finely barred with black; a chocolate bar on base of ventral; anal margined with white; an irregular black bar on shoulder and upper half of pectoral; everywhere more or less blotched with darker; the blotches at times forming numerous bars across the back.

This species is most nearly related to *Gobius boleosoma* Jordan & Gilbert, and *Gobius fasciatus* Gill, from which it can readily be distinguished by its proportions and its color.

30. *Gobius boleosoma* Jordan & Gilbert.

Gulf Coast of the United States.

31. *Gobius fasciatus* (Gill.)

West Indian fauna.

No. 13,231, one specimen, $1\frac{3}{4}$ inches; Hayti. Weiland.

This species has so far been known only from an insufficient description of the types which seem to have been lost. We add a description of the specimen before us:

Head 4 in length ($4\frac{2}{3}$ in total); depth 6 (7); D. VI—12; A. 10. Scales in a median series about 30; in a cross-series 7.

Body slender, elongate; head somewhat pointed; profile rounded, not as much as in *G. garmani* and *G. boleosoma*; eye large, slightly longer than snout, $3\frac{3}{4}$ in head; interorbital area scarcely wider than pupil; mouth slightly oblique, maxillary extending to below anterior margin of pupil, $3\frac{1}{2}$ in head; lower jaw thin and flat; teeth strong, recurved, in a band in each jaw; the teeth of the outer series of the upper jaw enlarged, several times as large as those of the inner series.

Scales finely serrate (fallen off anteriorly); ante-dorsal region and breast naked.

Dorsal spines slender, filamentous near tip, not reaching second dorsal, $1\frac{1}{2}$ in length of head; second dorsal of moderate height; caudal (tips broken) about 5 in length, $1\frac{2}{5}$ in length of head; ventral not reaching vent, $1\frac{1}{5}$ in head; pectorals pointed, equal to the head in length.

Color yellowish, marbled with darker above; four oblong dark blotches along middle of sides; a darker spot at base of caudal; narrow dark stripes across nape; a faint dark stripe along upper margin of opercle, through lower margin of eye to snout; another extending from angle of mouth to edge of preopercle, then extending down along the margin of the preopercle and ending in a dark blotch on the lower part of the cheek; a dark spot on opercle; first dorsal with two curved bars; caudal with three rather broad dark bars; anal dusky; connecting membrane of ventral white, its first rays blackish, outer rays yellowish; lower parts yellowish.

32 *Gobius stigmaticus* Poey.

West Indian fauna; Southern United States to Rio Janeiro.

The specimens in the Museum are from Cuba and Rio Janeiro.

We have compared the specimens collected by Prof. Agassiz with the type of Poey. The Rio Janeiro specimens are darker than the type; the bars on the cheek are conspicuous, edged with white; the shoulder spot is larger than the eye. The third dorsal spine sometimes is very elongate, reaching the fifth or sixth dorsal ray; the last dorsal ray occasionally extends to the base of the caudal. Posterior canines of lower jaw conspicuous, two on each side in some examples. The canines are also present in the typical specimen.

33. *Gobius lyricus* Girard. (No. 13,109, Type of *Gobionellus costulesi* Poey.)

Depth $5\frac{2}{3}$ in length; head 4; D. VI—12; A. 12; pectoral

slightly longer than head. Scales on head much reduced, toward the caudal enlarged. Caudal long, lanceolate, $2\frac{1}{2}$ in length of body; highest dorsal ray $3\frac{1}{2}$; highest anal ray $3\frac{1}{2}$.

Color brownish, the first dorsal with dots on its spines; a light stripe near the upper and lower margins of the caudal fin.

The bottle No. 13,109 contains two specimens; the smaller one is *stigmaticus*, the larger we describe above, and we consider it identical with *Gobius lyricus* Girard.

Three other specimens of *Gobius lyricus* were collected on the Island of St. Kitts, W. I., by Mr. Garman. The largest is 3 inches long.

Depth 5 in length; head 4. The second and third dorsal spines extend to base of caudal; dorsal rays scarcely less than length of head, the last rays reaching past base of caudal; the caudal fin is two-thirds longer than the head, $2\frac{1}{4}$ in body. Color light brown, faintly marked with darker; the first dorsal with minute dark points, the lower fourth of the spines with simple dark spots, above which are jet black spots ocellated with white; the second dorsal fin dusky, darker posteriorly, the basal portion of the last half of the fin evenly black, the anterior four rays marked with dark points similar to the spots on the lower parts of the spines of the first dorsal; caudal dusky, with two light bars; anal plain, darker than body; ventral fins blackish, edged with white; pectorals blackish, with many series of white spots on the membrane, and short, white bars at base; branchiostegal membrane black, with a light margin.

34. *Gobius encaeomus* Jordan & Gilbert.

South Atlantic Coast of the United States.

35. *Gobius smaragdus* Cuv. & Val.

West Indian fauna to Rio Janeiro.

The specimens in the Museum were collected by Prof. L. Agassiz at Rio Janeiro.

36. *Gobius badius* (Gill).

Gobius bosci Sauvage, Bull. Soc. Philom., Paris, series 7. iv. 44. 1880.
Gill, Ann. Lye. Nat. Hist. New York, vii, 47, 1859. (Amazon).

Head 6 in total; depth about 7; D. VI—1, 10; A. 1.10; scales in a median series about 50, in a transverse series 18.

Anterior profile very oblique; a line of pores behind eye; a pore above each eye; two on upper half of ascending margin of preopercle; eye 4 in head; interorbital $\frac{1}{2}$ of orbit; caudal 5 in total length; pectorals 6; color reddish brown or "dark bay, with a posteriorly straight hoary dot in the center of each scale; on the back and sides above, the head is plumbeous, with two livid blue bands extending from the eye to the upper jaw."

37. *Gobius poeyi* Steindachner.

West Indian fauna.

38. *Gobius strigatus* O'Shaughnessy.

Gobius Kraussi Steindachner. Ichthyol. Beitr. VIII. 19. 1879.
West Indian fauna.

39. *Gobius sagitulla* (Günther). Panama.**40. *Gobius uranoscopus* Sauvage. Brazil.**

Sauvage. Bull. Soc. Philom. Paris; series 7, IV, 170. 1880.

Depth 7 in total length; head $4\frac{1}{2}$. D VI—10; A. 9; Scales 98.

Head 2 times as long as high; snout obtuse, shorter than eye; eye 4 in head, interorbital space very narrow, the eyes almost touching. Teeth of outer row much longer and stronger than the others. Soft dorsal high; caudal rounded; upper rays of pectoral not silk-like; ventrals long; brown, marbled with black; some brown points on caudal. Length .065 m.

(Brazil).

41. *Gobius oceanicus* Pallas.

West Indian fauna; south to Rio Janeiro.

The specimens in the Museum are from Rio Janeiro, Pernambuco, Porto Alegre, Nazareth, Sao Matheos.

42. *Gobius hemigymnus* spec. nov.

No. 27,124, one specimen, $1\frac{3}{4}$ inches. Dredged in the West Indies.

Head $3\frac{2}{3}$ in length, ($4\frac{1}{2}$ in total): depth $4\frac{2}{3}$ ($5\frac{2}{3}$); D VI—10; A 8. Scales smaller than in *G. paradoxus*, 17 series developed, 7 in a cross series on tail—fewer further forward.

Body compressed; depressed anteriorly, the greatest depth in this specimen being at the origin of the anal and second dorsal fins. Head wider than deep, rounded; profile much decurved from eye to mouth as in *paradoxus*; eye perfectly round, smaller than in *paradoxus*, $1\frac{1}{3}$ in the rounded snout, 5 in head; interorbital space scarcely wider than orbit; mouth somewhat oblique, larger than in *paradoxus*, the maxillary reaching beyond posterior rim of orbit; lower jaw slightly shorter than the upper; teeth in the upper jaw in a band, the outer series remote, and the teeth several times as large as in the inner row, all more or less movable; teeth in the lower jaw similar, a recurved canine on each side near the front.

Scales very weakly ctenoid, covering only the sides of the posterior half of the body, not extending quite to base of dorsal or anal fins even at their posterior insertion, the upper and lower edges of the caudal peduncle being likewise free from scales, the scaly region, however, being widest on the peduncle, and tapering forward to the central point opposite beginning of anal, where the scales are smallest.

First spine of the dorsal not elongate as in *paradoxus*, $1\frac{1}{2}$ in head, the 3d, 4th and 5th spines slightly exceeding the first in height, equalling the posterior rays of soft dorsal, which are little higher than the anterior rays of the soft dorsal; caudal rounded, about 4 in length of body, $1\frac{1}{4}$ in head; ventral not reaching vent, $1\frac{1}{2}$ in head; pectorals rounded, rather short and broad, $1\frac{1}{4}$ in head.

Color light olivaceous, without distinct markings, everywhere with minute dark punctulations; eight faint cross

bars from dorsal to middle of sides, which, close under dorsal fins, are formed of two blackish dots; eight black dots along lateral line, the last being at base of caudal; fins all smutty, the pectoral lightest, white on its anterior half, two dusky spots at its base; opercle ashy; a light bar at base of caudal; iris blackish blue, a short straight streak of same color from eye to upper lip; an irregular bluish mark on cheeks formed of punctulations closely crowded.

Related to *Gobius paradoxus* Günther, from which this species differs in the size of the mouth, the greater width of the head, the arrangement and number of scales, the first dorsal fin, the color, and other minor characters.

The specimen was dredged. Its exact locality is not known.

43. *Gobius paradoxus* Günther. Panama.

44. *Gobius seminudus* Günther. Panama.

XIII. CHONOPHORUS Poey.

45. *Chonophorus flavus* (Cuv. & Val.) Brazil.

The Museum contains two specimens (No. 13,076) from Bahia, collected by Professor Agassiz, and one (No. 13,094) from the Rio Doce, which may be referred to this species? Our description is taken from the specimens from Bahia.

D. VI—12; A. 11; Scales 55.

Body very elongate, depth $6\frac{1}{2}$ in length; mouth horizontal, lower jaw flat; teeth in two series in upper jaw, the outer ones enlarged; in the lower jaw the teeth are in a band.

Color yellow, with a row of faint ocellated spots along middle of sides; dorsal and caudal fins faintly barred; lines radiating from eye; a line along opercle and half way across pectoral; all the markings obscure.

The specimen from Rio Doce, like most of the specimens of other species from this river, is plain blue-black

46. *Chonophorus taiasica* (Lichtenstein).

Euctenogobius latus O'Shaughnessy. Ann. & Mag. Nat. Hist., Series 4, XV, 145. 1875.

Atlantic and Pacific Coasts of tropical America.

The specimens in the Museum are from Bahia, Rio Doce, Barbadoes, St. Vincent, St. Lucia, Dominica, Mendez, Martinique, Panama.

The color and form in this species vary much with the stage of growth of the individual; the young resembling the species of *Hadropterus* in color and shape.

In the Panama specimen the head is narrow and pointed, eye large; the series of spots along the sides, conspicuous and well defined; the caudal has three black bars instead of the usual nine or ten narrow lines; a black spot at base of caudal. Three specimens, collected by Mr. S. Garman at Dominica, are similarly marked, except the caudal, which has wavy black lines; specimens collected by him at St. Vincent are of a plain sand color. In the older forms the head becomes much widened, the premaxillary widens in front and projects over the lower jaw, the coloration often becomes less defined, varying from plain sand color to dark olive. The teeth in the young are proportionately larger; many of the teeth are lost with age, and they seem in much less regular series.

47. *Chonophorus mexicanus* Günther.

West Indian fauna.

XIV. LEPIDOGOBIOUS Gill.

§. *Lepidogobius*.

48. *Lepidogobius lepidus* Girard.

Californian fauna.

The specimens in the Museum are from San Francisco.

§. *Eucyclogobius* Gill.49. *Lepidogobius newberrii* Girard.

Californian fauna.

XV. MICROGOBIUS Poey.

50. *Microgobius signatus* Poey.

West Indian fauna.

The types are in the Museum.

51. *Microgobius eulepis* spec. nov.

No. 27,123, one specimen. Fortress Monroe, S. C. Mrs. C. N. Willard.

Length $1\frac{7}{8}$ inches. Head 4 in length ($5\frac{1}{3}$ in total); depth $5\frac{1}{2}$ (7); D. VII—15; A. 16. Scales, 50 in a longitudinal series, 14 in a cross-series.

Body elongate, scarcely compressed; head slightly higher than wide, the depth $1\frac{1}{3}$ in its length; eye large, longer than snout, $3\frac{1}{2}$ in head; snout 5 in head, rather broad, not pointed as in *thalassinus*; preorbital narrower than pupil; mouth very oblique, maxillary not extending beyond anterior margin of pupil, $2\frac{1}{4}$ in head; teeth in the upper jaw in a very narrow band, slightly enlarged in the outer series, largest towards angle of mouth; teeth of the lower jaw in a similar band, some of the outer ones in front long and slender.

Scales cycloid, rather large, crowded anteriorly, regularly arranged, not imbedded, as in *signatus*, not deciduous as in *thalassinus*; breast, nape and region along spinous dorsal naked. The first dorsal spine is equidistant from tip of snout and first anal ray; longest dorsal spine $1\frac{1}{2}$ in head; caudal fin about 4 in body; ventral not reaching vent, equal to the length of head, the basal membrane one-fourth of its actual length; pectoral equals length of head.

Color yellow or very light brown, dotted with minute dark points above; scales along back with a dark margin;

head and nape with minute points; spinous dorsal transparent, a marked black spot on the upper part of the membrane between fourth and fifth dorsal spines; other fins plain; a light vertical bar on the posterior margin of preopercle; no other bars or stripes anywhere.

This species is closely related to *Microgobius signatus* Poey, and *Microgobobius thalassinus* Jordan & Gilbert. It differs from the former chiefly in the number of fin rays and number of scales; it differs from *M. thalassinus* in having its scales firm, though not imbedded as in *signatus*, and in the length of the caudal and ventral fins. It differs from both in coloration.

52. *Microgobius thalassinus* Jordan & Gilbert.

Atlantic coast of the United States.

53. *Microgobius emblematicus* Jordan & Gilbert. Panama.

54. *Microgobius gulosus* (Girard.)

Gulf coast of the United States.

XVI. BARBULIFER gen. nov.

Body entirely naked; numerous barbels around the mouth and on the chin. Dorsal spines 7. Otherwise as in *Gobiosoma*.

55. *Barbulifer papillosus* spec. nov.

No. 26,186, one specimen. Key West, Florida.

Length $1\frac{1}{8}$ inches. Head $3\frac{1}{2}$ ($4\frac{2}{3}$ in total); depth $4\frac{1}{2}$ ($5\frac{2}{3}$); D. VII—9; A. 9.

Body short and robust, deepest below first dorsal spine; head blunt, profile straight from first dorsal spine to eye, much curved in front of eye; eye longer than snout, $3\frac{1}{2}$ in head; interorbital area two-thirds diameter of eye; snout blunt; mouth small, oblique; maxillary 3 in head, reaching to below anterior margin of pupil; lips thick.

About 21 barbels, in length one-half orbital diameter or longer, are arranged as follows: a series of seven cross the snout from one angle of the mouth to the opposite angle, the anterior three on the snout rather thick and colored (two of them nasal), all the others yellowish, the barbel nearest each angle of the mouth longer than any of the others; on the lower jaw a barbel near each rictus, two on the chin, behind which are two pairs of barbels; posterior to these and below the rictus are two barbels on each side; one slender barbel on each side of preopercle below the posterior margin of the eye.

Numerous rows of pores or papillæ on the head; one series extends straight downward on the anterior part of the opercle, from the upper end of which another series extends perpendicularly backward; other pores irregularly scattered on the opercle; a double series extends along edge of preopercle, the pores becoming larger and especially conspicuous below, meeting on the chin; six or seven series radiating from eye, extending to snout, maxillary, and opercular series below; a row of pores nearly surrounding the mouth, curving backward, encircling the nasal opening; one series about the eye posteriorly, otherwise none on top of head or nape.

Fins high and rounded; second dorsal higher than first, $1\frac{4}{5}$ in head, caudal very broad and rounded—equal to the head in length; anal lower than soft dorsal; ventral reaching two-thirds to vent, $1\frac{1}{3}$ in head; pectoral $1\frac{1}{4}$ in head.

Color yellow; upper half of body with a broad band of purplish spots; six diamond-shaped spots of darker cross the band, extending above and below it; nape, top of head and upper part of cheek covered with dark points; opercle light yellow, cheeks darker; an oblique bar of black points on upper half of pectoral base, a curved bar of fainter spots on base of caudal; fins otherwise colorless and transparent.

A second specimen, also from Key West, with fins broken

and the barbels and papillæ of the head more or less torn and obliterated, may perhaps be referred to this species, the proportions being the same.

Gobiosoma ceuthæcum Jordan and Gilbert, should be referred to this genus. *Barbulifer papillosus* is most readily distinguished from *ceuthæcus* by its deeper form, the depth of *ceuthæcus* being 7 in its length. The barbels in *ceuthæcus*, Dr. Jordan informs us, are quite small.

56. *Barbulifer ceuthæcus* (Jordan & Gilbert). Key West.

XVII. GOBIOSOMA Girard.

57. *Gobiosoma histrio* Jordan. Guaymas.

58. *Gobiosoma molestum* Girard.

Gulf coast of the United States. Bahia.

The specimens in the Museum are from Louisville, Ky., Pensacola, Florida; and No. 13,143, one specimen $1\frac{1}{2}$ inches, from Bahia.

This specimen agrees very closely with the specimens of *Gobiosoma molestum* from Pensacola, Fla., the fins being somewhat higher.

D. VII—11; A. 11. Head 3 in length; depth $3\frac{3}{4}$. Highest dorsal spine $1\frac{3}{4}$ in head, highest ray $1\frac{3}{4}$; caudal very broad and rounded, 1 in head; ventral reaching vent, $1\frac{1}{4}$ in head; pectoral slightly longer. Body highest below first dorsal spine, tapering to snout and to caudal peduncle; head slightly wider than high.

Color yellowish, with traces of dark cross shades; head, body, vertical and ventral fins with minute points; a black spot on the membrane of dorsal between first and second spines; fins otherwise uniform in color; pectorals plain.

59. *Gobiosoma bosci* (Lacépède.)

Atlantic coast of the United States..

The specimens in the Museum are from Florida; Somer's Pt., New Jersey; Charleston, S. C.; Fortress Monroe; Amelia Island, Florida; Hilton Head, S. C.

60. *Gobiosoma multifasciatum* Steindachner.*Gobius lineatus* Poey. Mem. de Cuba, ii., 392. 1860.

West Indian fauna.

No. 13,317, one specimen. St. Thomas; Hassler Expedition.

This specimen, seven-eighths of an inch long, agrees with Dr. Steindachner's descriptions of *G. multifasciatum*. We have not been able to find the type of *G. lineatus*, but Poey's description agrees with the specimen before us. As the combination, *Gobius lineatus*, has been used before, we have retained Steindachner's name.

61. *Gobiosoma zosterurum* Jordan & Gilbert. Panam.**62. *Gobiosoma ios* Jordan & Gilbert.**

West coast of the United States.

XVIII. CLEVELANDIA gen. nov.

Body long and slender; maxillary much produced, but not extending to the gill-opening; mouth horizontal. Dorsal spines four, very weak. Minute cycloid scales.

We have dedicated this genus to Daniel Cleveland, Esq., of the San Diego Society of Natural History. Mr. Cleveland has done much towards making known the fauna and flora of Southern California.

63. *Clevelandia longipinnis* (Steindachner.)*Gobiosoma longipinne* Steindachner. Ichthyol. Beitr.

viii, 27. (Las Animas Bay, Gulf of California.)

No. 13,151, one specimen. San Francisco. Cary.

Length $1\frac{1}{8}$ inches. Head 4 in length ($4\frac{3}{4}$ in total); depth $6\frac{2}{3}$ (7). D. IV—16; A. 17.

Scales in a median series, about 70; in a cross-series, about 18.

Body very much elongate, slender; head long and slender, depressed anteriorly much as in *Esox*; profile straight; eye moderate, slightly shorter than snout, $4\frac{1}{2}$ in length of head; interorbital area about as wide as pupil; ante-orbi-

tal area scarcely half diameter of eye; mouth large, maxillary extending much beyond orbit; lower jaw flat, slightly curved upward anteriorly; mouth very much as in *Esox*; teeth all small, in narrow bands in each jaw; the outer ones of the upper jaw slightly larger than the others.

Scales minute, slightly enlarged posteriorly; their margins plain, the anterior part of the exposed area lengthwise striated; breast and ante-dorsal area naked.

Distance from snout to insertion of first dorsal spine is contained $2\frac{2}{3}$ in body; the spines slender and short, 3 in head; inter-dorsal area equals snout and eye; dorsal rays slightly longer than the spines, the last ray not extending half way to caudal; caudal pointed, scarcely shorter than head; ventrals not reaching half way to vent, $1\frac{2}{5}$ in head; pectoral $1\frac{1}{2}$ in head; vent slightly behind middle of body.

Color light brownish; numerous darker spots of aggregated points along nape and upper half of body; belly white; head slightly darker than body; posterior edge of opercle white; an oblique silvery bar on the lower half of opercle, and a light blotch at the upper corner of opercle; cheek with black points; some light areas below eye; lower surface of head and posterior part of maxillaries plain; two dark bars on spinous dorsal; second dorsal with three or four dark bars; a curved black bar at base of caudal; remainder of caudal irregularly barred with dark; other fins plain.

The specimen we have described agrees well with Steindachner's description, except that he states that his specimens were entirely naked.

XIX. GILlichTHYS Cooper.

64. *Gillichthys mirabilis* Cooper.

Californian fauna.

XX. TYPHLOGOBIUS Steindachner.

65. *Typhlogobius californiensis* Steindachner.

Californian fauna.

Sub-family GOBIOIDINÆ.

XXI. TYNTLASTES Günther.

66. *Tyntlastes brevis* Günther. Panama.67. *Tyntlastes sagitta* Günther. Panama.

XXII. GOBIOIDES Lacépède.

68. *Gobioides broussoneti* Lacépède.

West Indian fauna; south to Rio Janeiro.

Specimens of this species were collected by Hartt and Copeland at Sao Matheos, Rio Janeiro, Rio Pará. There is also in the collection the type of *Gobioides barreto* Poey from Havana.

69. *Gobioides peruanus* (Steindachner).

West coast of South America.

Steindachner, Fisch-Fauna des Cauca & Flüsse bei Guayaquil. 42. 1880 (Guayaquil).

Head 5 in length; depth 11. D. 7, 17. A. I, 16.

Ante-orbital portion of head $2\frac{1}{2}$ in post-orbital portion; inter-orbital 5 in head; lower jaw slightly projecting; a series of large slender teeth in each jaw, behind which in each jaw is a narrow band of fine teeth. Caudal $4\frac{1}{3}$ in body, connected with both dorsal and anal by a membrane. Dorsal rays violet, the membrane yellowish; narrow, angular cross-bars on body.

XXIII. CAYENNIA Sauvage.

Body much elongate, dorsals united, caudal free from dorsal and anal; ventrals united, not adhering to belly;

teeth small, outer enlarged; anterior part of body naked, posterior part covered with cycloid scales.

70. *Cayennia guichenoti* Sauvage. Cayenne.

Sauvage. Bull. Soc. Philom. Series 7, iv, 57. 1880.

Head 9 in total; depth 17; D. VI, 17; A. 1, 16; vertebræ about 36.

Head deeper than wide; eye small, placed well forward; maxillary reaching to below posterior margin of eye; a low membrane connecting dorsal and caudal; caudal 7 in length; ventrals $1\frac{1}{2}$ in head; brownish, marbled with black anteriorly; length 0,400 (Cayenne).

Perhaps the most interesting fact connected with the study of the American Gobies is that six of the seventy species, distributed in four, probably five genera, are half naked. Three of these were known at the time Günther's catalogue was written, all from Panama. Since then, Sauvage has discovered another half naked species at Surinam; a sixth species, whose habitat is unfortunately not definitely known, has been added in this paper.

The American Gobies fall into four more or less natural groups—*Oxymetopontine*, *Eleotridine*, *Gobiine* and *Gobioidine*; and what is most remarkable, three of these sub-families have each one or more half naked representatives. How widely these half naked species may be distributed cannot be told from the few data. Nothing is known of them but that they exist. An explanation why they are found only in the waters of Central America and the West Indies, should not be attempted until it has been proved that they are confined to these waters.

Family CALLIONYMIDÆ.

XXIV. CALLIONYMUS Linnaeus.

71. *Callionymus calliurus* spec. nov.

No. 26265, one specimen. Off South Beach, Key West, 5 fathoms. Pourtales, 1869.

Head, to tip of opercular spine $3\frac{1}{2}$ in length (5 in total); depth 7 (9). D. IV—6; A. 4.

Body flat below, the ventral surface bordered on each side with a fold of skin which is wider than the pupil; a single lateral line; diameter of eye equal to length of snout, $3\frac{1}{2}$ in head; maxillary not extending to the eye; opercular spine with two barbs above, the anterior one larger and turned forward; gill-opening a minute foramen opening upward. The last dorsal ray equals the length of the head, and the first dorsal spine reaches its tip when the fin is depressed; ventral fins connected by a broad membrane to the middle of the outer pectoral region; pectoral fins. as long as the head.

Cheeks, opercles, connecting membrane of ventral fins and ante-pectoral region with milk-white spots; lower jaw black near the rictus; a series of black dots on branchiostegal membranes, one or two similar dots in front of pectorals, two on the cheek forming a series with the second branchiostegal spot; four black spots on the marginal membrane of the belly, other black spots above it; lower half of body with numerous dirty-white spots; pectorals transparent, ventrals dusky; membrane of anal sprinkled with minute black points aggregated into black spots in places, and with opaque white spots; caudal transparent, having minute points, its upper half with opaque milk-white bars running obliquely downward and backward from ray to ray; lower half with interrupted longitudinal lines of opaque white, alternating with black spots; dorsal transparent, with white and black dots most conspicuous between last rays; body marbled with light and darker.

This species is nearly related to *Callionymus pauciradiatus* Gill. The only description of that species is: "D. III, 6. A. 4. The preopercular spine is armed with three teeth above and terminates in an acute point." Ann. Lyc. Nat. Hist., N. Y., viii, 143, 1865. (Matanzas). The speci-

men before us has four dorsal spines and only two barbs on the preopercular spines; how they may agree or differ in other respects we are unable to tell. Until Dr. Gill's type is more fully described we feel justified in considering the specimen in the Museum the type of a new species.

72. *Callionymus pauciradiatus* Gill.

West Indian fauna.

73. *Callionymus bairdi* Jordan MS.

“D. IV, 9. A. 8. Preopercle with an antrorse basal spine above and 8 sharp teeth near the tip below.”

74. *Callionymus agassizii* Good & Bean MS.

DESMIDS OF THE PACIFIC COAST.

IDENTIFIED BY REV. FRANCIS WOLLE.

Collected at Donner, Truckee, and Reno, Nev., September, 1887.

The following is a list of the plants found, not contained in the report published in Bulletin 7, June, 1887:

1. *HYALOTHECA DISSILENS* Breb.
2. *SPHÆROZOSMA PULCHRUM* Bail.
3. *PENIUM INTERRUPTUM* Breb.
4. *CLOSTERIUM ACUMINATUM* Kg.
5. *ANGUSTATUM* Kg.
6. *STRIOLATUM* Ehrb.
7. *DELPONTII* Klebs.
8. *DOCIDIUM TRABECULA* Naeg.
9. *CALOCYLINDRUS CONNATUS* (Breb.) Kirch.
10. *COSMARIUM BROOMEI* Thwaites.
11. *COSMARIUM OVALE* Ralfs.
12. *EUASTRUM GEMMATUM* Breb.
13. *AMPULLACEUM* Ralfs.
14. *VERRUCOSUM* (Ehrb.), Ralfs.
15. *ANSATUM* (Ehrb.), Ralfs.
16. *STAURASTRUM COMMUTATUM*, Kg.
17. *CORONULATUM*, Wolle.

Beside these desmids, the vials contain the following forms:

18. *SPIROGYRA GREVILLEANA* (Hast), Kg.
19. *TENUISSIMA*, Kg.

20. *ULOTHRIA SUBTILIS*, Kg.
21. *STAUROSPERMUM QUADRATUM*, Kg.
22. *OSCILLARIA PRINCEPS*, Vauch. (Vauch).
23. *ZYGNEMA STELLIUM*, Ag.
24. *ÆDOGONIUM*—sterile.

The following, already noted in Bull. II, No. 7, are duplicate in the Nevada vials:

HYALOTHECA MUCOSA.

PENIUM DIGITUS.

CLOSTERIUM ROSTRATUM.

COSMARIUM CRENATUM.

CUCUMIS.

ORNATUM.

PACHYDERMUM.

TETRAOPHTHALMUM.

TUMIDUM.

XANTHIDIUM CRISTATUM.

EUASTRUM BINALE.

ELEGANS.

STAURASTRUM ARCTISCON.

AVICULA.

DEJECTUM.

DICKIEI.

ECHINATUM.

INCONSPICUUM.

MUTICUM.

SEBALDI.

**DETERMINATION OF BROMINE IN SEA WATER BY
FRACTIONAL TITRATION.**

BY F. GUTZKOW.

Read before the California Academy of Sciences, February 6th, 1888.

This method of quantitative determination of bromine consists of three operations—

- 1—Separation of the bromine as cuprous bromide.
- 2—Conversion of the cuprous bromide into zinc bromide.
- 3—Titration by hypochlorite of sodium.

1ST OPERATION.—*Separation of the bromine as cuprous bromide.*—I mix 250 c.c. of filtered sea-water from the Pacific Ocean, to which a drop or two of sulphuric acid has been added, with 100 c.c. of a solution containing 25 grm., more or less, of crystallized cupric sulphate. To this clear solution, in which the copper may be assumed to exist as cupric chloride, I add from a graduated glass a solution of ordinary good sodium sulphite, the strength of which I need not know, until the brown flocculent precipitate which each addition produces will dissolve more and more slowly. It is easy to find a point when the brown precipitate has dissolved by digesting, but the solution remains slightly turbid from shining crystals of cuprous bromide. The separation of crystals increases rapidly, cuprous chloride being also separated. An excess of sulphite of soda does not matter much. By heating to about 40° C. the green liquid becomes blue again. Then, after cooling by water, another addition of sodium sulphite is made, say one-third of the volume previously used, again heated until the blue color distinctly reappears (about 70° C.); the flask is once more cooled by water and allowed to settle, after removing any traces of sodium sulphite remaining in the neck by shaking

with the liquid. It is advisable to loosely cork the flask. It will be found that the precipitate of mixed cuprous chloride and bromide is an unusually heavy one, settling rapidly from a perfectly clear liquid, from which any little particles floating on the surface can be made easily to sink (by a glass rod or judicious shaking), so that the liquid may be decanted to almost the last drop after short settling. The solution has become strongly acid by the sulphuric and sulphurous acid formed through the reaction between cupric chloride and sodium sulphite. For the 250 c.c. of sea-water employed about 3 grm. of copper have been separated, varying in amount somewhat according to the temperature after heating and after cooling. Heating to the boiling point only increases unnecessarily the copper separated. The second addition of sodium sulphite I found necessary for removing the last trace of bromine. Now, in order to test if all bromine has been separated, I add to the decanted liquid another portion of sodium sulphite, say as much as the second time, heat and cool as before, treat the precipitate by zinc and hydrochloric acid, as will be described hereafter, filter some of the solution of zinc chloride obtained into a test tube and test by one drop of the standard chlorine solution and chloroform, whether after shaking, the chloroform turns yellow. If it does not it is certain there is no trace left in the decanted liquid.

By these operations bromine can be very conveniently and completely separated in about ten minutes. Enough cupric sulphate ought to be added to form cupric chloride also from the sodium sulphite, as this is partially converted into sodium chloride by the formation of cuprous salts. In analyzing saline solutions other than sea-water, I ascertain the specific gravity and the corresponding percentage in sodium chloride from the tables, and reckon three parts of crystallized cupric sulphate for one part of sodium chloride, assuming all dissolved salts to be sodium chloride, as an excess of copper does not matter.

2D OPERATION.—*Conversion of the cuprous bromide into zinc bromide.*—This is accomplished by zinc with the addition of a little hydrochloric acid. The operation is an easy one, and would seem to require no explanation. But for the 3d operation, the titration, I require a small volume, say 25 c.c., in our case. A judicious economy of water and acid is, therefore, imperative. The precipitate in the flask is digested with about 100 c. c. of cold water, to which about 1 grm. of sulphuric acid has been added. The settled liquid is decanted as before, the last portion over a very small filter. Any iron which the cupric sulphate may have contained is now reduced to a no longer appreciable amount, and the sulphurous gas much reduced. But in order to destroy the last trace of the latter, I add a few drops of sodium carbonate and spread the crystalline powder around the flask. After one or two minutes enough oxychloride will be formed to answer the purpose afterwards. Now I rinse the contents of the flask into a porcelain dish, using only a few cubic centimeters at one time; heat in a test-tube about 5 c. c. water, with $\frac{1}{2}$ c.c. hydrochloric acid, and filter over the small filter I had been using into the flask. A little more water applied to filter and flask will clean both sufficiently. The dish is heated on a water bath, and when by smell I detect no sulphurous gas, I add one large amply sufficient piece of zinc.

The white crystals will soon be replaced by copper and a clear solution of cuprous chloride in hydrochloric acid. The finished reduction I recognize by touching with the point of a glass rod first the liquid and then a drop of sulphuretted hydrogen water spread on a porcelain plate. Enough acid must be present to prevent the formation of oxychloride of zinc. The contents of the dish, copper and all, are filtered over a small filter, directly into a small graduated cylinder, and ought not to give more than 10 or 15 c.c. filtrate. The copper is then fully sweetened into another porcelain dish with about 25 c.c. of hot acidulated

water and the filtrate evaporated to about 5 or 6 c.c., with the addition of one or two drops of sodium carbonate, then made acid again and added to the 10 or 15 in the graduated cylinder, and the water used for rinsing the dish utilized to fill up to 25 c.c.

3D OPERATION. — *Titration by hypochlorite of sodium.*—I must suppose that the chemist who takes interest in the subject treated here is acquainted or makes himself acquainted with what Fresenius in the sixth edition of his celebrated book remarks on titration of bromine. He will find that all these titrations are based on liberating bromine by chlorine and on the color imparted by free bromine to water, or chloroform or other absorbent. My method offers nothing new in that respect. Generally chlorine water is used as standard solution, which is the most changeable liquid employed in volumetric analysis. Figuier removes the bromine liberated by boiling; Reimann by chloroform. In the first case it requires better eyes than mine to recognize coloring when there are only one or two milligrams of bromine left, and in the second, frequent removal of the chloroform is necessary; for, while the decoloration of a small drop of chloroform slightly colored is a sure and delicate test, the change of color in a highly colored drop of chloroform is a very coarse one.

As standard solution I use hypochlorite of sodium or potassium, that is, ordinary "Eau de Javelle," as prepared by druggists (by treating "chloride of lime" with sodium or potassium carbonate), containing, generally, from one to two per cent. of chlorine, which may be set free by an acid. The slight excess of the carbonate employed does not interfere. I dilute one part of the commercial liquid with five parts of water, and test its strength by a normal solution of potassium bromide, acidulated by sulphuric acid. This normal solution I prepare by dissolving 1 gm. potassium bromide in water, add diluted sulphuric acid containing about 2 gm. SO_3 and fill up with water to say one-half liter.

Then I ascertain the bromine in a given volume either by argentic nitrate and chlorine gas or by titration with the standard solution of hypochlorite of sodium, which has been previously assayed for chlorine by one of the usual methods. Deducting the volume used for assay I dilute until the normal solution contains one milligram per cubic centimeter.

Although the standard solution of hypochlorite of sodium is by no means unalterable, still it is much less changeable than chlorine water. For instance, a solution prepared three weeks ago and indicating 100 milligrams of bromine by 18.8 c.c., requires to-day 19.6 c.c., weakening by 4 per cent. This weakening is, however, no matter, as it amounts to only .01 c.c. per day for 25 milligram. of bromine, and I recommend, in all cases, to test its strength immediately previous to the assay on the unalterable normal solution of bromine. This is preferable to its test by an iodide of potassium, etc., solution, which Fresenius (*Quant. Anal.*, § 143, β) recommends, deviating in this one little instance from the fundamental principle of volumetric analysis expressed by him elsewhere, that the test ought to be made, if possible, always in the same manner as the assay.

The novelty of my method is a kind of fractional titration which allows to foretell the final reaction on an aliquot portion of the liquid, and—in the case of bromine—to compare the color before and after addition of the chlorinated standard solution. This kind of titration is advantageous also for other determinations, especially those which have a very sudden final reaction, as, for instance, the analysis of caustic soda. For the last named kind of analysis I proceed as follows: The apparatus consists of a flask provided with a well-fitting cork with two holes. Through one of these holes passes a little bent glass tube, stopping short at the cork inside and connecting outside with a rubber tube and clamp or “clip.” Through the other hole passes a long funnel to nearly the bottom of the flask. I prefer the kind

of funnel called thistle-shape, or, better, poppy-head shape. It must hold 30 to 40 c.c. A mark by file or paper glued on shows when the funnel is filled with 20 c.c. I measure the solution of caustic soda to be tested and dilute to a round figure, say 100 c.c., add litmus and fill into the flask, opening the clamp. By blowing through the tube I raise 20 c.c. into the funnel and close the clamp. I note the stand of the burette, say = 0.00 c.c., add one drop of standard acid; the solution remaining blue, I may add four more drops for the 80 c.c. in the flask, because $\frac{1}{5} = 20$ c.c. were not changed. I do so; find that I have been using .25 c.c. in five drops, that the liquid remained blue, and that I may add safely $4 \times .25$ or 1.25 c.c., including the five drops already given. I bring the burette to 1 c.c. to get at round numbers; still blue color. I may add four more c.c., and do so, $\frac{1}{2}$ c.c. at a time, stirring with a little glass rod which I leave always in the funnel, and observe that with 3 c.c. the contents remained blue, but become red with $3\frac{1}{2}$ c.c. Now I know that the final reaction will occur between $3 \times 5 = 15$, and $3\frac{1}{2} \times 5 = 17\frac{1}{2}$ c.c. I open the clamp and run standard acid to the 15 c.c. mark of the burette, shake and wash the funnel by raising and lowering repeatedly the mixed liquid. I raise again to 20 c.c. in the funnel, close the clamp and begin my second test, adding, as before, 1 drop; the liquid remaining blue, I add 4 more. Still blue. I may, consequently, give $5 \times .25$ c.c. = 1.25 c.c. I do so, but only .10 c.c. or 2 drops at a time, because I know that I am approaching the final reaction below 17.5 c.c. Having added .30 c.c., the liquid remains blue, but turns red at .40 c.c. I may add $5 \times .30$ but not $5 \times .40$ c.c. I open the clamp and proceed as before, bringing the burette to 16.50 c.c. I raise again 20 c.c., which I still, to be on the safe side, count as $\frac{1}{5}$, although it has become now nearly $\frac{1}{6}$ th of the whole. I add one drop of acid: blue, another: red. I go no further, because I know I am within 3 drops of the final reaction. I remove cork and funnel and add the next drop

directly to the flask, find that the third drop will turn red, and read 16.9 c.c. off the burette.

The following table will show how the observations may be conveniently noted, + and — signifying respectively blue and red:

	ADDITION					STAND OF
	TO $\frac{1}{5}$		TO THE WHOLE.			BURETTE.
	MADE.		ALLOWED.	FORBIDDEN.	MADE.	0.00 c c.
No. 1..	1 drop	+	5 dr.=.25 c.c.	.....	.....	.....
	.25 cc.	+	1.25 c.c.	.....	.....	.....
	.50	+	.....	.....	.....	.....
	1.00	+	5.00	.....	.....	.....
	3.00	+	15.00	.....	15.00 c.c.	15.00
	3.50	—	.....	17.5 c.c.	.....	.....
No. 2..	1 drop	+	.25	.....	.....	.....
	.10 c.c.	+	.....	.....	.....	.....
	.20	+	1.00	.....	.....	.....
	.30	+	1.50	.....	1.50	16.50
	.40	—	.....	2.00	.....	.....
No. 3..	1 drop	+	.25	.....	.25	16.75
		+			3 drops	16.90 c.c.

For the analysis of bromine I modify my apparatus as follows: The flask holds about 70 c.c. and has a round bottom, if possible, egg-shape, and short and wide neck, so that a cork with three borings may be fitted. One of these holes serves for a small bent glass tube, with rubber tube and clamp attachment as described above. Instead of one funnel I have two, as much as possible of equal size and of similar shape as described, each holding 10 or 15 c.c. Into one of the two cups I place a short and thin glass-rod, bent so that the heaviest part is inside the cup, and graduate (with the little glass-stirrer inside) for one and for five cubic centimeter. The tube of the other funnel is bent above the cork, so that

both funnels will rest side by side in equal and least possible height above the cork. Both tubes are, now, cut off, so that they reach nearly to the bottom of the flask. They ought to be as narrow as a reasonably fast flow of the liquid from flask to cups will allow. As I could not procure funnels to satisfy me in this respect I shoved a narrow tube through the straight tube, flanging it a little so that it found a support in the conical bottom of the cup, and closed the lower opening of the bent tube partially. Thus, when the air is compressed in the flask the liquid will travel in both tubes with tolerably equal speed. The graduated cup with the straight tube serves for fractional titration, the other one to compare the original color with the changes of color produced by the additions from the burette to the graduated cup.

Everything being prepared, I pour 25 c.c. of my normal solution of potassium bromide through one of the funnels into the flask, raise 5 c.c. or $\frac{1}{2}$ to the corresponding mark in the cup, close the clamp and assay in similar manner as described above.

No. 1.—I add one drop of the solution of hypochlorite of sodium of unknown strength. A yellowish tint is noticed, faint but unmistakable. I am allowed to add four more drops. I do so, and observe deepening of the color with every drop. Having, thus, spent .25 c.c. I am allowed to add 1 c.c. more or 1.25 c.c. in all. I add .25 c.c. at one time, stir and observe that the color becomes more intense by stirring. The next .25 c.c. do not seem materially to increase the color although it does not decrease. Therefore, I add only .10 c.c. at one time, note .85 as doubtful, observe with the next drop a probable decrease of color, which decrease becomes more marked with the second drop, and quite decided and unmistakable with the third. I know, now, that the assay will be finished between $5 \times .75 = 3.75$ c.c., and $5 \times 1 = 5$ c.c., probably already $5 \times .90 = 4.5$ c.c. I lower the stand in the burette to 3.75 c.c., which makes

the contents of the graduated cup nearly as light as those of the other cup, open the clamp, mix and wash the cups as described above. As I know that I am very near the finish, I raise only to the 1 c.c. mark.

No. 2.—I add one drop: the 1 c.c. gets quite light compared with its partner in the other cup. I blow, now, into my rubber tube, open the clamp while blowing, in order to prevent the sample from sinking back into the flask, and raise to the 5 c.c. mark. This permits a better observation than adding the drop at once to the 5 c.c. I compare the two colors at my leisure. The result is doubtful. The color seems to have neither increased nor decreased. The next drop shows a decided decrease of color on comparing both cups. I cannot go any further with fractional titration, being, probably, within three drops of the end of the assay. I open the clamp, remove the cork and funnels after washing rod and cups with water, and boil the contents of the flask until the color has become quite white and no more smell of bromine can be noticed. I cool by water, add one c.c. of chloroform, close the flask with my thumb, shake violently and observe whether the chloroform has become colored. If not, as it will not be if all the bromine has been evaporated, I add one drop from the burette and shake as before. In the settled little drops of chloroform (the advantage of a pointed egg-shape of the flask will show now) I recognize distinctly a yellowish tint. The next drop leaves me uncertain if there is any change in color. The third drop shows without fail an almost complete decoloration. The assay is finished. By deducting the last drop and one-half of the former drop, I learn that 25 milligram. bromine are indicated by 3.925 c.c. of my standard solution. Each drop of .05 c.c. will, henceforth, disclose ($\frac{3.925}{78.5}$ being = $\frac{2.5}{78.5}$) or about $\frac{1}{3}$ of a milligram of bromine. The limits of accuracy depend of: (1) the least possible number of drops for testing by chloroform; (2) the least possible amount of

chloroform, that is: (3) the least possible volume of solution, because, the more solution the more chloroform must be given to obtain drops of sufficient quantity for a good observation of color.

The following table will record the results of this assay in a better shape, + expressing increase, — decrease of color, ? doubtful.

		ADDITION				STAND OF
		To $\frac{1}{5}$	To THE WHOLE.			BURETTE
		MADE.	ALLOWED.	FORBIDDEN.	MADE.	0.00 c.c.
No. 1.....	{ 1 drop = .05 c.c.	+	.25 c.c.	.....	.....	.....
	.25	+	1.25	.....	.....	.....
	.50	+	2.50	.....	.....	.....
	.75	+	3.75	.....	.....	.....
	.85	?	.....	.....	.....	.....
	1.00	—	.....	5.00 c.c.	.....	.....
	.....	..	.....	.....	3.75 c.c.	3.75
No. 2.....	.05	?	.....	.05	.30	.....
	.05	—		.25		.10	3.85
No. 3.....	.....	..	WITH CHLOROFORM:			.....
	.....	+				.05
	.....	?				.05
	.....	—				.05
	.....	..	less the last $1\frac{1}{2}$ drops:			.075
						3.925 c.c.

It will be observed that the one dangerous calculation in this titration was the fourth of No. 1, which brought me on a not perfect observation too near to the result. I choose intentionally this example for pointing out the danger of adding too much from the burette on the observation of the first fractional titration, when the second cup contains still colorless liquid and offers no chance for comparison of colors. The increase of color becomes easily fallacious

after a certain intensity has been obtained, but not the decrease. The record of "addition allowed to the whole" ought to be based on certainty, which may be won by another fractional titration. The following table will explain how the titration ought to have been made:

	ADDITION					STAND OF BURETTE.
	To $\frac{1}{5}$		TO THE WHOLE.			
			MADE.	ALLOWED.	FORBIDDEN.		MADE.
						0.00 c.c.
No. 1..... {	1 drop = .05 c.c.	+	.25 c.c.	.....	.....	.....
	.25	+	1.25	.....	.....	.....
	.50	+	2.50	.....	.....	.....
	.75	?	.....	.....	.....	.....
	.85	?	.....	.....	.....	.....
	1.00	—	.....	5.00 c.c.	.....	.....
	.....	..	.....	.....	2.50 c.c.	2.50
No. 2.....	.05	+	.25	.....	.....	.....
	.10	+	.50	.....	.....	.....
	.20	+	1.00	.....	.....	.....
	.30	?	.....	.....	.....	.....
	.40	—	.....	2.00	.....	.....
	.....	..	.....	.....	1.00	3.50
No. 3....	.05	+	.25	.....	.....	.....
	.10	?	.....	.....	.....	.....
	.15	—	.....	.75	.....	.....
	.....	..	.....	.....	.25	3.75

etc., like No. 2 of the foregoing table.

To sum up, this kind of titration is based at the beginning on coloration, and toward the finish on decoloration, of the fraction in the cup. As long as three drops are required to produce a decoloration, another fractional titration may be safely undertaken; but when already two drops change the color decidedly, it is better to stop and proceed to the final test with chlorotorm. These remarks refer, of course, only to a standard solution of about the strength indicated here.

The titration of the 25 c.c. obtained from the 250 c.c. of sea-water is done in exactly the same manner as that of the normal solution of potassium bromide, except that the observation of the first drop from the burette requires special attention. In the presence of iron (from the zinc) or copper, both being under the circumstances ferrous or cuprous salts, no bromine will be set free until they have been converted by the chlorine into ferric and cupric salts. Therefore, before commencing on the fractional titration, I empty the 25 c.c. into the flask, add one cubic centimeter chloroform, also one drop from the burette, shake, and observe whether the chloroform shows coloring. If it does, I evaporate the drop of chloroform by boiling the contents of the flask while keeping them in agitation, cool, return the solution to the graduated cylinder, fill up to 25 c.c. and titrate in the manner described above, adding the one drop from the burette used for coloring the chloroform to the account.

The more experienced analyst will, however, be able to recognize the first color without requiring chloroform, and thus avoid boiling the solution previous to titration, which may cause a slight loss by evaporating some hydrobromic acid, unless sodium carbonate is added. For the titration, the solution has then to be made acid again. Whilst by this preliminary test traces of iron, manganese, copper and sulphurous gas can be detected and made harmless, the presence of hyposulphite of zinc (formed by the action of sulphurous gas on zinc) affects the assay more seriously, as it is less readily oxydized, completely only when the titrated solution is boiled to evaporate the free bromine. This causes formation of hydrobromic acid—hence the necessity of guarding against the presence of sulphurous gas before zinc is added. Every analyst will judge what other substances may be present in his solution which might interfere, and how to remove them.

It remains to state that the titration as described may also

be applied to a solution of zinc bromide and chloride obtained by reducing a precipitate of argentic bromide and chloride by zinc. But more zinc will be required than for the reduction of cuprous bromide and chloride. Argentic nitrate will precipitate 5 grm. of chlorine from 250 c. c. of sea-water, while in the precipitate obtained in the manner described there are only $1\frac{1}{2}$ grm. For this reason, and on account of the comparatively large volume of the argentic chloride, it is less easy to obtain a small volume of solution for titration.

Fehling's method of partial precipitation by argentic nitrate, with its difficult settling and sweetening of the precipitate, and absence of a ready test for ascertaining whether the bromine has been completely separated, I leave out of consideration here.

The amount of bromine in the sea water near the entrance to the Bay of San Francisco, determined in the manner described, is 67.5 milligrams in one liter.

CHANGES IN THE FAUNA AND FLORA OF CALIFORNIA.

BY H. H. BEHR, M. D.

A residence of nearly forty years in this vicinity, during which the country has been rapidly settled, has necessarily made me a witness of many changes in the Flora and Fauna, and it seems to me a matter of importance that some record of these changes be made. Such records of the physical changes abound and are of very great interest, but the mutations of organized life are certainly equally so, and they have had no historian.

From time to time, in the progress of a busy life, I have taken notes of various such changes, and propose to give them to the Academy in the shape of a series of short papers.

1. Serpents.

The venomous serpents of this vicinity, of which only one species (*Crotalus lucifer*) occurs, have, as is well known, very greatly decreased in number, indeed it is probable that very few, if any, now exist on the peninsula of San Francisco. They are, however, still found in considerable numbers on Tamalpais, that wild and only half-explored mountain at our doors, and in the range of hills back of Oakland and Berkeley, and in certain sections there has certainly been a local increase in their numbers.

As two of the places where they are increasing are to me well-trodden grounds, I have made some investigations of the causes of this increase, which is sufficiently marked to be noticed by casual visitors, and of course still more by residents of the districts.

Statistics in such matters being out of the question, I have only to mention the reasons which have convinced me of the local increase, to which my attention was first called

by resident friends. First—Comparative frequency of snake bites to cattle in one locality and to dogs in the other. Second—The appearance of very young rattlesnakes, so called “one-buttons” before dark. I do not know the habits of the Crotalides of other regions, but our *Crotalus lucifer*, is, in the first year of his existence, even more nocturnal in his habits than full grown specimens, and the appearance of one before sunset is always exceptional.

The first locality to which I refer is in the Contra Costa mountains, whose eastern chain is there broken by a deep ravine, a transverse valley carrying the waters of the table lands into the alluvial plains about Alvarado.

My authority is a landed proprietor, blessed with a taste for zoölogy, as far at least as that branch of science is connected with sportsmanship.

The greater part of the land surrounding his place is very hilly, and the declivities partly naked and rocky, partly wooded, only accessible by a few trails, most of them impracticable for saddle-horses. The upland, used only for grazing, is open grass-land, dotted occasionally with live-oaks, but having no *chapparal* whatever.

There is but little agriculture in the immediate neighborhood, but a considerable number of “chicken ranches,” the owners of which carry guns and possess dogs of somewhat roaming dispositions. There is but little game left excepting quail. Hawks, eagles, owls and herons, were formerly abundant, but have perceptibly diminished. The grazing country seems to contain few reptiles excepting rattlesnakes. *Ophibolus*, *Pityophis* (magnificent specimens), and several species of *Eutainia* are found in the gulch and along the sides of the creek, but no *Crotalus*, as far as the observations of my friend extend.

The pasture grounds of the upland are well stocked with cattle and horses. There are but few goats, and at present no sheep, and none of the farmers keep hogs to any extent.

The other locality to which my attention has been specially called is in the Coast Range. Its drainage is partly to the Bay of San Francisco, partly into the ocean. The elevation varies from 1,000 to 3,000 feet above the level of the sea.

I have several statements from inhabitants of this district, all agreeing as to the fact of an increase of rattlesnakes, but differing in regard to the causes. The informant upon whose statement I chiefly rely has seen a great deal of border life, some military service, and has made explorations in Mexico and the Indian Territories. His observation is keen and is the more reliable because not influenced by preconceived ideas.

The lower part of this district must have been originally a dense forest of redwood (*Sequoia sempervirens*), Douglas spruce (*Pseudotsuga Douglasii*), madroño (*Arbutus Menziesii*), and chestnut oak (*Quercus densiflora*); the upper part, chaparral (*Ceanothus* and *Manzanita*) and chemisal (*Adenostoma*), varied occasionally by groves or forest strips of *Pinus insignis* and *Pseudotsuga Douglasii*, live-oak (*Quercus agrifolia*), and Kellogg's oak (*Quercus Kelloggii*).

At this day tracts of cultivated land, chiefly vineyards and orchards, form frequent interruptions of the original forms of vegetation. There is still game enough to cause much inconvenience to the vine-growers, but it has, according to the statements made to me, perceptibly diminished. The hills are steep, but not so much so as to prevent the growth of chaparral upon them; the gulches accessible, but not broad enough to be of much use to the agriculturist; and though there are no large water-courses, there are plenty of springs.

Among reptiles, *Gerrhonotus* and *Phrynosoma* are the most common. The serpents are not well represented. I have not seen *Ophibolus*; the blue racer (*Bascanion*) has been only occasionally seen; *Pityophis* is exceedingly rare, and even

the species of *Eutainia*, otherwise so universally distributed, are not often met with; the rattlesnake has, however, distinctly gained ground.

The population consists chiefly of the owners of large tracts of land, most of them in easy circumstances, and employing a good deal of manual labor in orchards and vineyards. The farmers keep some cows and horses on their premises or a neighboring hillside, but the region can hardly be called a grazing country.

The professional sportsman or pot-hunter rarely visits the district, but boys and dogs of roaming disposition abound, and account in some measure for the diminished number of eagles, hawks and owls.

Let us now consider the causes which have led to the increase of so very undesirable a neighbor as *Crotalus lucifer*.

First.—The protection given to it by the nature of the country; the inaccessible hillsides and uninhabited upland abounding in gopher and squirrel holes of the Contra Costa, and the impenetrable thickets of chaparral in the Coast Range. These conditions change only very slowly with the settlement of the districts.

Second.—Destruction of its natural enemies.

There are very few persons carrying a gun who can resist the temptation of killing an eagle, a hawk or an owl, and many of them are probably ignorant of the fact that by so doing they preserve a rattlesnake or even a whole brood of them. Eagles and hawks will, I know, occasionally help themselves to a chicken or a young turkey, but their warfare is usually directed more against gophers, squirrels, snakes, etc., avoiding as long as possible the dangerous vicinity of the hencoop with its hysterically noisy inmates and attendant shot-gun.

Owls are even more useful in keeping in check the undue increase of these animals, especially the rattlesnake, as their nocturnal habits bring them in frequent contact with the "one-button," the hopeful descendent of the mature *Crotalus*.

There are some other allies still to be mentioned, who give us no inconsiderable assistance in our attempts to get rid of the rattlesnake. One of these is the king snake, *Ophibolus getulus*. An incident which occurred in a drug store in this city, where various living reptiles are kept in a glass case, proves that the statement of the prowess of this snake made by old rancheros are founded on actual observation, and not as has been supposed, on vague tradition.

A specimen of *Ophibolus* being one day added to the happy family, attacked a rattlesnake immediately on its entrance, and winding himself by an exceedingly rapid motion round the latter strangled him, but not before receiving a wound from the fangs of his foe from which he died the next day.

The confined space, preventing freedom of movement, in which the conflict took place, was probably the cause of this mishap. Similar statements have been made in regard to *Pityophis*. As to *Eutaenia* we may be certain that these defenseless species do not disturb the rattlesnake, and as their food is chiefly frogs and small fish they do not interfere with his food supply as *Pityophis* certainly does, by feeding on ground squirrels, gophers, rats, mice, etc., and *Ophibolus* still more, by climbing shrubs and devouring the eggs and young of birds, a cheerful nocturnal custom of the rattlesnake also.

In relation to the amount of help given by these enemies of the rattlesnake, they rank about as follows:

First.—Owls, which feeding on the strictly nocturnal "one-button," destroy a greater number of individuals, needing more for food on account of their small size.

Second.—Hawks and eagles, which destroy many of the mature snakes moving about in the day-time.

The diminution in the number of these birds, at least as far as the Coast Range is concerned, is probably largely due to the forest fires, which are, I am sorry to say, very frequent in some parts. The owl builds usually in old hollow trees, which are of course more easily destroyed by fire than sound ones. The eagle builds every year, if undisturbed, in the same tree, and is very apt to leave a region where its nest has to be frequently changed. Of course these fires do not directly injure the birds, for they occur late in the year, after the fledging of the young.

Ophibolus and *Pityophis* are comparatively trifling factors in the destruction of the rattlesnake, nevertheless it would be wiser to leave inoffensive creatures unharmed, for they are his implacable enemies, and perform a very considerable service to the farmer by lessening the number of vermin, and it is after all a very cheap kind of heroism to wantonly kill an animal which is incapable of doing harm.

Nature not interfered with by man is perfectly able to take care of herself. When once we do so all the "bisulphides" and "insect washes" in the world will not restore the balance which has been disturbed; *naturam expellas furca tamen usque recurret*," says Horace. We can only make Nature our ally, never our servant.

A NEW GENUS AND SPECIES OF N. A. SCARABÆIDÆ.

BY J. J. RIVERS.

The insect about to be noticed, would in general appearance remind any one of *Pentodon*, but an examination of the mouth parts would at once dispel the idea, the strongly toothed outer margin in *Pentodon*, together with the highly developed teeth of its maxillary galea, would seem to remove those insects to different associates. The one I now mention has a history; it adorns several collections either without a name or else labeled *Aphonus clunalis* Lec. A reference made to LeConte's description of *A. clunalis*, *Proceed. Acad. Nat. Sci., Phila., Vol. 8, p. 23, 1856*, and at the end of the description the following phrase "*maxillarum galea bidentata*," is sufficient to show that LeConte did not refer to the present insect, for its maxillary is entirely *unarmed*.

There appears to be no description of this insect anywhere in the literature of N. A. Coleoptera; and thinking that as this species was from El Paso, Texas, Mr. W. Bates, of England, who is working upon the Mexican Scarabæidæ, had perhaps received and already incorporated it in his monograph, I wrote to him concerning it. He replied: "Proceed and describe it; send me a copy of the publication containing the description, and I will adopt your naming if I find the species among those occurring across the line."

This insect was in a large capture of Scarabæidæ taken last year at El Paso, Texas, by G. W. Dunn, after whom the specific name is formed; the generic name is derived from the unarmed condition of its galea or maxillary. The group it belongs to is very puzzling, as it appears to possess diverse characteristics; the tarsal form and lack of stridulating organs throw it with *Aphonus*; the style of sculpture of the elytræ is of the common oblique pattern, while the shape

of the middle and hind tibiæ, together with the bulging upon the pygidium, point towards *Oryctes*, and the rounded form of the club of the antennæ also favors *Oryctes*, though it matches *Pentodon* in that character very much better and it agrees with none in its unarmed galea.

ANOPLOGNATHO gen. nov.

Form oval, convex; dorsum gently rounded; under wings well developed.



Clypeus triangular, with sides slightly emarginate, apex rounded and curving upwards; in fresh unworn examples the margin is continuous, and meets a depression on either end of the sutural line; this transverse line rises towards the center, but the center itself is slightly depressed.

Antennæ nine-jointed, the basal joint very large, equal to all the joints of the funicle; the fifth and sixth joints being connate, makes this truly a nine-jointed species.

Labrum membranous, covered with stiff hairs.



Mandibles much produced, not toothed externally, but with a slight emargination.

Maxillæ much flattened and widening from the middle to the front edge, the inner angle is sharply defined and with a projecting joint, the outer angle much rounded; the under surface has stiff bristly hairs pointing forwards.

Maxillary palpi four-jointed; the first joint narrow, the second and third about equal, and the fourth nearly as large as the second and third combined.

Labium bilobed, with well rounded margins.



Mentum connate with the several adjoining parts, the labial palpi appearing at the sides, they are three-jointed, the first joint being shorter than the second and the third equal to both.

Prothorax shining black, wider than long and narrower in front, front margin recurved, smooth, side margins slightly reticulated and reflexed, but becoming flattened before reaching the hind angles; hind margin well developed from the angles by an impressed line, which dying out before reaching the center the margin is continued by coarse puncturings only.

Elytræ elongate-oval wider towards the apex, evenly rounded on top, falling to the sides in a gentle curve.

Anterior coxæ large, with the trochanter oval in outline, the outer end fitting into an emargination of the epimera.

Middle coxæ nearly the size of the former, of irregular form, with the

apex somewhat truncate. Posterior coxæ small and subtriangular, oblique.

Abdomen: ventral segments six; fifth and sixth movable.

Spiracles situated upon the inner edge of the inflexed portion of the ventral segments except the posterior one, which is in the suture, where the propygidium meets the fifth ventral segment. The middle and hind tibiæ have each two oblique carinæ across the middle portion, and their apices are expanded and digitate.

Middle tarsi moderately stout, first joint more robust, the second and third of equal length, and the fourth shorter.



Hind tarsi shorter than those of the middle pair; more robust and more equal in length.

Propygidium regularly rugose, what might be called reticulate.

Pygidium very obtusely and evenly rounded in the male.

Anoplognatho Dunnianus sp. nov. — Elongate-oval, convex, broader behind. Clypeus triangular, with the sides slightly emarginate, tip rounded, upturned; the edge carries a raised margin that meets the sutural line, which increases in height towards the middle, but is cut by a slight depression in the center, giving the outline of a double curve. This character, however, is not constant. There is no other armature on the head. Vertex rugosely punctate, as is the depression forming the area of the clypeus. Prothorax transverse, narrower in front, angles pointed, sides reflexed, partly reticulated but flattened before reaching the hinder angles; hind margin well defined part of the way across from the angles, but continued over the middle by punctures only. The middle of the disc towards the hind margin is free from punctures, but towards the side margins they become closer and merge into each other, while at the front angles they form a densely rugose surface. Elytræ elongate-oval, wider behind the middle, and covering the propygidium; the sutural margins near the apex appear depressed, but it is caused by elytron by the usual broad tubercle; obliterated striae, the two inner sets pying an oblique course from base obtusely rounded. Front tibiæ low, the various parts are clothed the color is deep chestnut. Above, of the elytræ, becomes almost smooth the bulging on either there are three series of being double, and occu- to apex. Pygidium very strongly sinuate. Be- with hairs placed in lines; the surface, particularly and shining; the color is brownish black, inclining to a chestnut tone towards the hinder part of the elytræ.



Length .95-1 inch.

Female generally smaller, with the sides of the elytræ more parallel; it is more convex than the other sex, the elytræ shorter *not* covering the propygidium, and smoother. Pygidium obtuse but not evenly bulging, because the lower part is incurved and margined by a bold edge. Front tibiæ strongly tridentate. Length .75-.95 inch.



Locality: El Paso, Texas.

A NEW SPECIES OF CALIFORNIAN LEPIDOPTERA.

BY J. J. RIVERS.

This insect is from the neighborhood of Truckee, a mountainous district of California. It has been mistaken for a variety of *M. anicia* Doubl., but as this has a black ground color while *M. anicia* has a red one, they must belong to different groups of the same genus. Mr. C. F. McGlashan has for several years bred this insect in numbers and distributed it generously, therefore I have great pleasure in dedicating the species to him.

M. Chalcedona Doubl. is the type around which numerous forms congregate, some as mere varieties, while others, though showing strongly their ancestry still exhibit sufficient likeness to each other in the imago state, to puzzle and perplex the student, and make it difficult to say whether these various forms are simply variations or true species. In the larval state, however, abundant difference is seen which easily points out the genuine species. Dr. H. Behr in his description and remarks upon *M. Cooperi*, Proceed. Cal. Acad. Sci., Vol. 3, p. 90, 1863, says: "With all the well marked differences, the species look so much alike, that it would have been a long time before *M. Cooperi* would have been recognized as a distinct species, if it had not been for the striking difference of its caterpillar."

MELITÆA Fabr.

M. Macglashanii sp. nov. General appearance like *M. Chalcedona*, but still more like *M. Cooperi* Behr. Outer margins of upper wings rounding in both sexes. The general disposition of the spots forming the bands being equidistant, gives to the whole surface a more checkered appearance than is seen either in *M. Chalcedon* or *M. Cooperi*. Expanse of wing of the largest ♀ specimen $2\frac{1}{4}$ inches; in the largest ♀ specimen of *M. Chalcedon* $2\frac{3}{4}$ inches. *The marginal band of red spots to all the wings always present.*

Male.—Upper side blackish; outer margins of all the wings with reddish spots, a character more constant in this species than is found in either *Cooperi* or *Chalcedon*. The next two rows are pale straw or even white, and the spots are inclined to be quadrate; the usual bifid band has the third

and fourth spots from the costa wholly red; three spots in cell, two yellow and one red; hind wings have first a row of marginal red spots, followed by three rows of yellow, then, in some, an elongated twin spot of red; the basal area has four angulate spots of yellow, three forming a triangle. Under side of anterior wings a subdued brownish-red, the marginal row scarcely defined; in some examples, however, there is a black zigzag line that cuts off the marginal row; the second and third rows are repeated faintly, and the markings of the upper surface are faintly visible; hind wings have an unbroken marginal border of red which continues firmly along a third of the inner margin. The second band consists of seven conical spots of yellowish white; the third row is made up of rounded or angulate spots of red, attended more or less by a yellow halo, and in some specimens the spot is circular, and a dot or pupil adorns the center; the fourth row contains eight large elongate spots of whitish-yellow, cut unequally by a black line, but the first spot on the front margin is almost equally divided; the basal area is red and contains three yellowish spots, the largest of which is sometimes divided by a reddish spot. Female exhibits the same markings as the male; with the exception of the marginal borders and a faint tinge of red on one horn of the bifid band, the whole surface is of sombre black.

Palpi reddish; antennæ yellowish; abdomen with five dorsal segments fringed with rusty brown, and a white row of spots on each side of the dorsal ridge; beneath, through the center, it is whitish.

Expanse: male $1\frac{1}{2}$; female $2\frac{1}{4}$ inches.

Larva.—Deep black, sparingly irrorated with white. Seven of the dorsal spines light yellow, with a fine line of deeper yellow forming a ring around the base of each. A double line or band of white occupies the dorsal region, interrupted by the base of the spines, and longitudinally separated by a fine black line that runs along the dorsal ridge; the sub-dorsal row of spines black on a black ground, the next row of spines also black, but at the base below each of seven spines is a yellow crescent-shaped spot which interrupts a broad spiracular band of white; the next row of spines black, then a narrow longitudinal line of scattering white spots; then follows, above the feet, a row of twin diminutive yellowish spines, which interrupts a line of white. Beneath is a double line of white. The hairs below the spiracular line brownish. The head, prolegs, base of feet and spines (except the seven dorsal) black and shining. Caterpillar looks very like that belonging to *M. Leanira*, and therefore more attenuated than that of the robust *M. Chalcedon*.

Food plant *Pentstemon*, but will feed upon the flowers of *Castilleja*, and upon the leaves of *Plantago major*.

Chrysalis.—Dull white, prothorax with two yellow tubercles, the first dorsal segment has also two, the second three, the fourth to the tenth have five tubercles on each dorsal segment. In the front of each tubercle is a black curved spot often uniting. There are also some black spots on each

segment placed in regular order, but there are no black dots on the apex of the tubercles as seen in the allied species. Length $\frac{3}{4}$ inch.

CLISIOCAMPA.

C. thoracica Stretch. Larva.—Body obscure brown, dorsal ridge ornamented with a row of conspicuous ochre-colored spots, two spots on each segment, the one placed in front always much the larger; the spots are attended by numerous short waving lines of reddish-brown, running longitudinally, and there is a sub-dorsal line of the same color, and a spiracular line of a much lighter shade. Its whole length above the feet is occupied with numerous tufts of grayish hair.

The dorsal line of spots is its most particular feature, as it contrasts with the sombre tone of the body color. Length $1\frac{1}{4}$ to 2 inches.

Natural food plant the native willow, upon which it is found feeding at Berkeley, but it has taken to the foliage of different kinds of orchard trees, upon which great damage has been done.

CONTRIBUTIONS FROM THE SHAW SCHOOL OF BOTANY.

No. 4.

SYNOPTICAL LIST OF NORTH AMERICAN SPECIES OF CEANOTHUS.

BY WILLIAM TRELEASE.

In its present limitation, *Ceanothus* is an exclusively American genus, and all but three of the species known to me occur north of Mexico. It is quite puzzling to the student of our flora, partly because of the variability of some species, and partly because in some instances what are evidently distinct species approach each other so closely as to render their characterization difficult, although they may be pretty surely recognized by the practiced eye. To the evolutionist, these groups of interlocking sub-species and barely distinguishable species, are interesting as representing different stages in the mutations of their prototypes; but they are exceedingly trying to the systematic botanist, whose task is to so arrange and limit them as to render their recognition by others easy.

Aside from the monograph of the genus (in the broader sense in which it was formerly understood) in De Candolle's Prodrômus, which characterizes very few of the species that are now known, and the fuller revision in the first volume of Torrey and Gray's Flora, it has been very judiciously and completely treated by Mr. Watson in a revision of the entire group (Proc. Amer. Acad. x. 1875, 333-9), and a separate elaboration of the numerous and difficult Californian species (Bot. Cal. i. 102-104; ii. 439). His views on the synonymy of species are also very fully indicated in his Bibliographical Index to North American Botany. Nor should the field notes of the keen-sighted Nuttall, on a number of the Pacific Coast species, in Torrey and Gray's Flora, be overlooked.

In the main, the limitation and descriptions of species in Mr. Watson's monograph, and his references to literature, in the Index, are so accurate as to require little alteration; but after repeatedly going over the genus as represented in the Gray, Engelmann, and Torrey herbaria, and in the extensive collections of the California Academy of Science, and the United States Department of Agriculture, as well as the fine private herbarium of Mr. J. C. Martindale, it has seemed to me that *Ceanothus* is capable of subdivision into more natural groups than have yet been proposed, and the following is offered as a tentative arrangement of our species, I shall be very grateful for specimens and notes elucidating doubtful species, and I desire here to express my obligation to the botanists who have already placed public or private collections in my hands for study.

A. Leaves alternate, not spinescent, glandular-toothed or occasionally entire; stipules thin, often subulate, fugacious; fruit sometimes keeled or crested on the back of each segment, but not bearing prominent dorsal horns.—*Euceanothus*.

a. Inflorescence on leafless lateral peduncles borne on the old wood.

1. *C. SANGUINEUS*, Pursh. Fl. Am. Sept. i. 167; Watson, Proc. l. c. 334, Index, 166.—British Columbia to Idaho and California.

b. Inflorescence on leafy shoots of the present season's growth.

* Flowers white, in small simple corymbose clusters terminating mostly leafy spineless twigs: leaves very small (2 to 8 mm. long), 3-nerved.—Atlantic species.

2. *C. MICROPHYLLUS*, Michx. Fl. i. 154; Watson, l. c. 335. Georgia to Florida.

3. *C. SERPYLLIFOLIUS*, Nutt. Gen. i. 154; Watson, *l. c.* 335.—Georgia. The locality in Nuttall's Genera, and on an original specimen in the Gray herbarium, is Florida.

* * Flowers white: inflorescence rather simple and mostly compact, at the ends of slender usually leafless or nearly leafless peduncles: twigs subterete, not spinose: leaves ample or medium-sized (15 to 75 mm. long), thin, toothed, 3-nerved: fruit about 4 mm. in diameter.—Atlantic or Rocky Mountain species.

4. *C. AMERICANUS*, L. Spec. 195; Watson, *l. c.* 333, Index, 163.—Ontario to Manitoba, south to Florida and Texas.

5. *C. OVATUS*, Desf. Arb. ii. 381; Watson, *l. c.* 334.—Canada and the lake region to Texas.

VAR. *PUBESCENS*, Watson, Index, 166.—Rocky Mountain region.

* * * Flowers blue: inflorescence compound, ample, on leafy branches: twigs conspicuously sulcate: leaves medium-sized (25 to 50 mm. long), prominently 3-ribbed, minutely glandular-serrulate: fruit mostly 5 or 6 mm. in diameter.

6. *C. THYRSIFLORUS*, Esch. Mem. St. Petersburg Acad. x. 285; Watson, *l. c.* 334.—Mountains of Western California.

* * * * Flowers blue (often pale) or white: inflorescence compound, rather loose, on few-leaved branches: leaves entire, mostly medium-sized.—Pacific species.

÷ Twigs (more or less spinose in the first) usually somewhat angled and often twisted: leaves rather firm or even coriaceous.

↔ Leaves rather broad, not at all 3-nerved: fruit 5 to 6 mm. in diameter.

7. *C. SPINOSUS*, Nutt. in Torrey & Gray, Fl. i. 267; Watson, l. c. 337.—Middle and Southern California.

8. *C. PALMERI*, n. sp. Glabrous throughout, or a very few hairs on the leaves and petioles: branches greenish, becoming brown: leaves mostly on short spurs, slender-petioled, about 40 mm. long, elliptical or ovate-oblong, rounded at both ends, mucronate or emarginate, entire, thinner than in the last: flowering branches ascending, naked or few-leaved: inflorescence oblong, nearly simple: exocarp of fruit rather fleshy.—Mountains of Southern California (Palmer, 1875, No. 42). Intermediate between *C. spinosus* and *C. integerrimus*.

↔ ↔ Leaves narrow, 3-nerved, the nerves often concealed by the revolute margins; fruit about 3 mm. in diameter.

9. *C. PARRYI*, n. sp. Branches glabrate or sparingly villous, strongly sulcate, more or less papillate: leaves narrowly elliptical-oblong, obtuse, 15×30 mm. or less, glandular-serrulate, glabrous above, the lower surface rusty-tomentose, at least along the veins: inflorescence oblong, interrupted, terminating recurved-ascending slender, few-leaved branches: flowers blue.—Known to me only from specimens found in cultivation at Calistoga, Cal. (Parry, 1881, No. 33).

÷ ÷ Twigs not spinose nor rigid, very slightly angled while young: leaves thinner, at least the largest 3-nerved: inflorescence rather dense for the group; fruit about 4 mm. in diameter.

10. *C. INTEGERRIMUS*, Hook. & Arn. Bot. Beechey, 329; Watson, l. c. 334, Index, 165. *C. thyrsiflorus*, var. *macrothyrsus*, Torrey, Bot. Wilkes, 263! California to Arizona.

11. *C. PARVIFOLIUS*. *C. integerrimus*, var.? *parvifolius*, Watson, *l. c.* 334.—California to Oregon.

***** Flowers blue or white: inflorescence mostly compound and ample: leaves generally medium-sized to large, 3-nerved; margin various.

÷ Twigs not spinose nor conspicuously glaucous, the youngest angled in the first species: flowering-branches few-leaved or leafless: leaves broad, usually large (25 to 75 mm. long): fruit about 5 mm. in diameter.

12. *C. ARBOREUS*, Greene, Bull. Cal. Acad. ii. 144. *C. sorediatus*, Lyon. Bot. Gaz. xi. 204, 333.—Islands off the Californian Coast.

14. *C. VELUTINUS*, Dougl. in Hook. Fl. Bot.—Am. i. 125, pl. 45; Watson, *l. c.* 334.—British America to California, Colorado and Nebraska, chiefly in the mountains.

VAR. *LÆVIGATUS*, Torr. & Gray, Fl. i. 686; Watson, Index, 167.—Range of the species.

÷ ÷ Twigs terete, often very divergent and rigid, some of them ending in firm spines.

++ Twigs short, often very glaucous: leaves large in the first, mostly medium-sized, rather small in the last: fruit 4 to 6 mm. in diameter.

14. *C. INCANUS*, Torr. & Gray, Fl. i. 265; Watson, *l. c.* 336.—California.

15. *C. EGLANDULOSUS*. *C. divaricatus*, var. *eglandulosus*, Torrey, Pac. R. R. Rep. iv. 75. *C. divaricatus*, Watson, *l. c.* in part.—Mountains of California and Lower California.

16. *C. DIVARICATUS*, Nutt. in Torr. & Gray Fl. i. 266, 686; Watson, *l. c.* 336 in part. — California and Lower California.

VAR. *GROSSE-SERRATUS*, Torrey, Pac. R. R. Rep. iv. 75. — California.

17. *C. CORDULATUS*, Kellogg, Proc. Cal. Acad. ii. 124, f. 39; Watson, *l. c.* 337. — Mountains of California.

++ ++ Twigs slender, usually slightly if at all glaucous: spines slender and sharp: leaves rather narrow for the group: fruit about 4 mm. in diameter.

18. *C. FENDLERI*, Gray, Pl. Fendler 29; Watson, *l. c.* 337. Mountains of Colorado, New Mexico and Arizona.

VAR. *VIRIDIS* Gray, in Herb. — Arizona (*Lemmon. Greene*).

* * * Flowers deep blue (except sometimes in the first), in rather compact nearly simple corymbose or oblong clusters, on leafless or nearly leafless (sometimes abbreviated), usually scaly peduncles: twigs terete, mostly spineless, and not very rigid. — Pacific species.

+ Leaves medium-sized, all or nearly all 3-nerved: twigs rather more rigid in forms of the first two than elsewhere in this group: fruit about 4 mm. in diameter.

19. *C. SOREDIATUS*, Hook & Arn. Bot. Beechey, 328; Watson, *l. c.* 336. — Coast Range of Southern California, extending into Lower California.

20. *C. HIRSUTUS*, Nutt. in Torr. & Gray, Fl. i. 266; Watson, *l. c.* 336. *C. diversifolius* Kellogg, Proc. Cal. Acad. i. 58, 65. — Mountains of Southwestern California.

VAR. ? *GLABER*, Watson, *l. c.* 336. — East Humboldt mountains, Arizona. (Watson, No. 212.)

21. *C. DECUMBENS*, Watson, *l. c.* 335.—Mountains of Central California.

÷ ÷ Leaves usually small, commonly only the largest 3-nerved, not papillate: fruit 3 mm. in diameter.

22. *C. DENTATUS*, Torr. & Gray, *Fl. i.* 268, Watson *l. c.* 335.—Coast range of Southern California.

SUBSP. ? *FLORIBUNDUS*. *C. floribundus* Hook. Bot. Mag. pl. 4806; Watson, *l. c.* 338.—Known certainly only from plants grown in European gardens, from Californian seed.

SUBSP. ? *LOBBIANUS*. *C. Lobbianus*, Hook. Bot. Mag. pl. 4810.—Coast Range of Southern California.

23. *C. IMPRESSUS*, n. sp. Villous, with short spreading hairs: leaves broadly elliptical to nearly orbicular, 6 to 8 mm. long, loosely villous, especially on the veins below, the upper surface deeply furrowed over the midrib and several pairs of lateral nerves, the slightly glandular margin very revolute, appearing there as if crenate: peduncles about 10 mm. long, scaly toward the base: inflorescence sub-globose, compact: fruit not seen.—Santa Barbara County, Cal.

÷ ÷ ÷ Leaves medium-sized, oblong, not at all 3-nerved, papillate.

24. *C. PAPILLOSUS*, Torr. & Gray, *Fl. i.* 268; Watson, *l. c.* 337.—Mountains of Western California.

25. *C. VEATCHIANUS*, Hook. Bot. Mag. pl. 5127; Watson, *l. c.* 338. — Described and known only from European plants raised from Californian seed.

B. Leaves opposite or alternate, pinnately veined, coriaceous, often pungently toothed; stipules thick and spongy, taper-pointed persistent; inflorescence densely corymbose, on short spurs from the new wood; fruit usually large for the genus, each carpel commonly bearing a dorsal horn, an alternating set of 3 crests or horns frequently at or near the apex.—*Cerastes*
Species of the Pacific Coast or Southwest, mostly with rigid almost spinose twigs.

- a. Procumbent and radicant: flowers bright blue (except occasional albinos or hybrids), mostly on long, slender, colored pedicels.

26. *C. PROSTRATUS*, Benth. Pl. Hartweg, 302; Watson, *l. c.* 339.—Washington Ter. to California and Nevada.

- b. Erect or spreading, the branches mostly rigid: pedicels usually stouter or rather short.

* Leaves opposite.

+ Flowers (always?) white.

27. *C. CUNEATUS*, Nutt. in Torr. & Gray, Fl. i. 267; Watson, *l. c.* 338 and Index, 164, in part. — Oregon to Lower California.

28. *C. GREGGII*, Gray, Plant. Wright. ii. 28; Watson, *l. c.* 338.—Utah, Arizona and New Mexico to Mexico.

29. *C. CRASSIFOLIUS*, Torr. Pac. R. R. Rep. iv. 75; Watson, *l. c.* 338 and Index, 164, excl. synonym and variety. —Coast range of Southern California, Lower California and Californian islands.

+ + Flowers blue (or rose-purple?).

30. *C. RIGIDUS*, Nutt. in Torr. & Gray, Fl. i. 268; Watson, *l. c.* 339. —Coast region of Southern California.

VAR. *GRANDIFOLIUS*, Torr. Pac. R. R. Rep., iv. 75; Watson, Index, 164, under *C. crassifolius*. *C. crassifolius*, var. *glabratus* Gray, Cat. Bolander, 8; Watson, Index, 164.—Range of the species.

** Leaves alternate; flowers white.

31. *C. verrucosus*, Nutt. in Torr. & Gray, Fl. i. 267; Greene, Bull. Cal. Acad. ii. 81. *C. cuneatus*, Watson, l.c. 338, and Index, 164, in part.—Southern California and Lower California.

32. *C. macrocarpus*, Nutt. in Torr. & Gray Fl. i. 267; Greene, l. c. *C. cuneatus*, Watson, l. c. 338, and Index, 164, in part.—Coast Range of Middle and Southern California.

NOTES.

C. sanguineus appears to differ from all other species of the genus in flowering from wood of the preceding season's growth; otherwise, it is related in several respects to Nos. 4 and 5.

C. microphyllus and *serpyllifolius*—very closely related to each other—show no very great affinity for other groups. For convenience they are placed where they now stand, although in the character of the inflorescence, they approach the *dentatus* group. I have no fruit of either.

While *C. ovatus* is well marked in its typical Eastern form, it passes gradually into var. *pubescens* in the West, and through this approaches *Americanus* in its leaf-forms. The leafiness of flowering branches is sometimes quite variable.

In *C. spinosus*, the firm leaves commonly turn brown in drying, especially the upper surface; the branches of the ample somewhat leafy loose thyrsus mostly spread at right angles or are even recurved; and the flowers are scarcely more than lilac-colored.

C. parvifolius appears to be distinct from *integerrimus* in its loose low habit, smaller leaves scarcely exceeding 25 mm. in length, the majority of them not 3-nerved, and in its smaller oblong or (from the falling of the lower fasci-

cles) subcorymbose inflorescence of blue flowers—those of *integerrimus* appearing to be always white.

C. arboreus is, as Professor Greene has shown, the largest of our species. It was collected on Sta. Catalina many years ago, by Nuttall, who notes its arboreous habit on the label accompanying a specimen in the herbarium of the Philadelphia Academy.

Numbers 14 to 17 of the list are quite difficult to distinguish.

C. incanus, with large, rather thin, nearly smooth elliptical leaves, often rounded in abruptly to the lateral nerves, a short distance above the base, usually entire, pale below; rather large white flowers (often 5 or 6 mm. in expanse); and large depressed fruit with a more fleshy exocarp than usual, is generally recognized without much difficulty. The same is true of *C. eglandulosus*, which is nearly glabrous and very glaucous, with rather small strongly ovate entire or nearly entire leaves, usually brown above, in herbarium specimens; and smaller dingy blue flowers. But *divaricatus* and *cordulatus* approach each other so closely that it is hard to draw the line between them. The specimens with smaller, thicker leaves are commonly referred to the latter, as being evidently what Kellogg figured, while the former species usually has large and more flexible leaves.

C. Fendleri, with rather thin narrower leaves, silky-canescens in the type, green and nearly glabrous in the variety; stands out quite well from its congeners, in geographical distribution, also.

C. soledadensis is a species which I do not at all understand. As it is here accepted, it includes plants with slender rather simple twigs, and others that are quite rigid and intricately branched; the leaves of some are very broadly ovate, while others are narrower; and the pubescence varies from silky

or more or less hirsute to very densely white- or rusty-tomentose on the lower surface of the leaves. The inflorescence is intermediate between that of the preceding and following groups of species. In some of the rather slender-stemmed plants that I regard as most typical, the twigs are very rough with crowded small warts. Probably one or more species may ultimately be separated out, and it is not certain that a number of specimens now referred here do not really belong to *divaricatus* on the one hand, or *hirsutus* on the other.

The *dentatus* group is one of the best circumscribed, but it is not less puzzling than others, for it is doubtful whether the forms it comprises are best described as species or varieties. *Lobbianus* is chiefly characterized by its conspicuously unequal leaves—those on the primary shoots 25 mm. long, mostly acute at both ends, the larger 3-nerved.

While I have scarcely felt that this form and *floribundus* are worthy of specific rank, I have pretty confidently separated out the plant with rather broad hairy leaves, deeply furrowed over the veins. It is known to me only from two flowering specimens in the Gray herbarium, collected at different places.

In CERASTES the species are quite as perplexing as in EUCEANOTHUS, and the difficulty of separating them is increased by the occurrence of what appear to be hybrids. This is especially true of *prostratus* and *cuneatus*, typically very distinct in habit, foliage, flowers and fruit; but numerous specimens have been collected over a large area, showing various combinations of the characters of both. So marked are these that Mr. Thomas Howell writes me that from his field observations he is disposed to regard *prostratus* as only a variety of *cuneatus*.*

* On these supposed hybrids, see Garden and Forest, i. 7.

The fruit of *prostratus* is usually considerably longer than broad, about 8 mm. in diameter, rather fleshy, with 3 nearly erect prominent horns, and an accessory set of apical crests or smaller horns.

Cuneatus produces subglobose or very slightly elongated fruit, about 6 mm. in diameter, with thin flesh, and usually 3 rather small horns, an accessory set of smaller ones being occasionally seen.

C. Greggii, closely related to *cuneatus*, is marked by its leaves, often white-tomentose below, mostly equally rounded and acute at both ends, frequently with one or two small teeth on either side, and its rather pointed fruit, about 4 mm. in diameter, seemingly nearly or quite hornless, the white calyx-lobes more persistent than usual.

C. crassifolius, as it is now accepted, is very heterogeneous, embracing plants with entire or toothed smooth green leaves, and others with the leaves pungently toothed, revolute margined, and very white-woolly below. The fruit is as much as 8 or 10 mm. in diameter, depressed-globose, smooth or with 3 low deeply dorsal horns, and the base (invested by the adnate calyx) very prominent, and indurated. The leaves are always firm and thick.

C. rigidus has thinner, often cuneate-obcordate, mostly denticulate leaves, and blue or purplish flowers. Good fruit is desirable. Some specimens suggest hybridization with *C. prostratus*.

C. verrucosus is very similar to *rigidus* in its foliage characters, but with slender twigs, alternate leaves and white flowers. The figure of *rigidus* in Bot. Mex. Bound. pl. 9, is evidently this species. Its fruit is mostly 4 to 6 mm. in diameter, with small dorsal horns, or none.

C. macrocarpus approaches broad-leaved forms of *cuneatus*, and especially entire-leaved forms of *crassifolius*, in its foliage, but its habit is said to be arborescent, its twigs are slender, and its leaves opposite. Its fruit is very similar to that of the entire-leaved *crassifolius*, but with prominent dorsal horns.

PRELIMINARY NOTES ON SOUTH AMERICAN
NEMATOGNATHI.

I.

BY CARL H. EIGENMANN AND ROSA SMITH EIGENMANN.

The present paper contains a list of the species of Hypophthalmidæ, South American Siluridæ, Argiidæ and Callichthyidæ, and of the genus *Plecostomus* (Loricariidæ), with the localities of the specimens contained in the Museum of Comparative Zoölogy at Cambridge, Massachusetts, and descriptions of the following new forms:

1, *Pimelodina nasus*; 2, *Luciopimelodus*; 3, *Pseudopimelodus acanthochirus*; 4, *Rhamdia obesa*; 5, *R. Poeyi*; 6, *Rhamdella* (sub-genus); 7, *Rhamdia tenella*; 8, *R. eriarcha*; 9, *R. parryi* (Mexico); 10, *Pimelodella*; 11, *P. pectinifer*; 12, *Sciadeoides* (sub-genus); 13, *Duopalatinus*; 14, *Steindachneria*; 15, *S. amblyurus*; 16, *Pseudoplatystoma fasciatum intermedium*; 17, *Tachisurus lentiginosus*; 18, *T. jordani*; 19, *T. longicephalus*; 20, *T. agassizii*; 21, *T. gulosus*; 22, *Ageneiosus atronasus*; 23, *Auchenipterus fordicei*; 24, *Felichthys flavescens*; 25, *Trachycorystes porosus*; 26, *T. analis*; 27, *Hussar*; 28, *Doras uranoscopus*; 29, *D. spinosissimus*; 30, *Decapogon*; 31, *Corydoras hastatus*; 32, *Plecostomus limosus*; 33, *P. comersonii scabriceps*; 34, *P. seminudus*; 35, *P. macrops*; 36, *P. vermicularis*.

The specimens in the Museum were collected by Professor Louis Agassiz and his assistants during the Thayer Expedition in Brazil, and by Professor Agassiz and Dr. Steindachner during the Hassler Expedition around South America. The names of collectors of new forms are given with the descriptions.

A fuller account of all the species mentioned will be published later.

HYPOPTHALMIDÆ.

I. HELOGENES Günther.

1. *Helogenes marmoratus* Günther.

II. HYPOPTHALMUS Spix.

Notophtthalmus Hyrtle; *Pseudohypophtthalmus* Bleeker.

2. *Hypophtthalmus edentatus* Spix.

Hypophtthalmus marginatus, *H. longifilis*, and *H. spixii* Cuv. & Val.

Hypophtthalmus edentulus Castelnau; *Hypophtthalmus fimbriatus* Kner; *Hypophtthalmus perporosus* Cope.

Locality: Para.

SILURIDÆ.

I. CALLOPHYSUS Müller & Troschel.

Pimelotropis Gill; *Pseudocallophysus* Bleeker.

1. *Callophysus macropterus* (Lichtenstein).

Pimelodus clenodus Agassiz; *Pimelodus insignis* Schomburgk, in part: plate, but not description; *Pimelotropis lateralis* Gill.

Localities: Obidos; Lake Jose Assu; Cameta; Rio Negro; Santarem; Tonantins; Lake Manacapuru.

II. PIMELODINA Steindachner.

2. *Pimelodina flavipinnis* Steindachner.

3. *Pimelodina nasus* sp. nov.

Type, No. 7490. Length to base of caudal .34 m. Para. Agassiz.

This species differs from *flavipinnis* as follows: adipose fin 2 in the length ($2\frac{1}{2}$ in *flavipinnis*); eye 8 in head (6); head not compressed behind the eyes (compressed); greatest width of head $1\frac{3}{5}$ in its length (3); maxillary barbels reach to the end of the adipose fin (beyond base of caudal); head everywhere strongly convex in a cross-section (almost flat between the eyes); depth above ventrals $4\frac{1}{2}$ ($5\frac{1}{2}$ – $5\frac{3}{5}$); a dark humeral area, otherwise plain yellow (several rows of brown spots on the upper half of the body).

Elongate fusiform, the back compressed, trenchant;

width, above ventrals, $1\frac{2}{5}$ in the greatest depth. Head short, flat below, regularly convex above; profile very steep and almost straight. The thick skin obliterates the outlines of all the bones. Occipital process long and narrow, not reaching the dorsal plate.

Eye small, its anterior margin equidistant from the snout and the free border of the opercle, its diameter 4 in the snout, 8 in the head, $2\frac{1}{2}$ in the interocular. Posterior nasal opening a transverse slit.

Maxillary barbels reaching to or beyond the end of the adipose fin; mental barbels reaching beyond base of the pectorals, the post-mentals beyond their tips.

Mouth entirely inferior, the snout projecting beyond it more than one diameter of the eye; lower jaw weak, the teeth scarcely evident, in a very narrow band; the teeth of upper jaw in a somewhat wider band.

Gill-rakers 7+17.

Distance of dorsal fin from tip of snout $3\frac{1}{2}$ in the length; first dorsal ray high and slender, scarcely spinous; the free margin of the fin straight. Adipose fin beginning immediately behind the dorsal, its base 2 in the length.

Caudal fin deeply forked, the lobes of equal length, longer than the head.

Fourth anal ray highest, higher than the fin's base, 2 in the length of the head.

Ventrals inserted little nearer anal fin than to tip of snout, $1\frac{1}{5}$ in the head.

First pectoral ray scarcely spinous, slightly serrate on its inner margin, about as long as the head.

Axil and humeral region blackish, otherwise uniform yellowish.

Head $5\frac{1}{3}$; depth $5\frac{3}{5}$; depth of peduncle 13; Br. 9; D. 7; A. 12.

III. *PIRINAMPUS* Bleeker.

4. *Pirinampus pirinampu* (Spix).

? *Pimelodus barbancho* Humboldt; *Pirinampus typus* Bleeker.

Locality: Cameta.

IV. LUCIPIMELODUS gen. nov.

Type, *Pimelodus pati* Valenciennes.

First dorsal and pectoral rays not spinous, flexible and longer than any of the succeeding rays. Free margins of the dorsal and anal emarginate. Barbels scarcely margined. Head depressed; snout elongate spatulate. Fontanel continued to the base of the occipital process. Occipital process a mere ridge.

5. *Luciopimelodus pati* (Valenciennes).

Locality: Buenos Ayres.

6. *Luciopimelodus platanus* (Günther).

V. PSEUDOPIMELODUS Bleeker.

Zungaro Bleeker; *Batrachoglanis* Gill; *Lophiosilurus* Steindachner.

‡ *Lophiosilurus*.

7. *Pseudopimelodus alexandri* Steindachner.

Pseudopimelodus agassizii. Steindachner.

‡ *Batrachoglanis*.

8. *Pseudopimelodus parahybæ* Steindachner.

Pseudopimelodus charus Steindachner (not C. & V.)

Locality: Santa Cruz.

9. *Pseudopimelodus raninus* (Cuv. & Val.)10. *Pseudopimelodus pulcher* Boulenger.

§ *Pseudopimelodus*.

11. *Pseudopimelodus zungaro* (Humboldt.)

Pimelodus bufonius, *charus* and *mangurus* Cuv. & Val.; *Zungaro humboldtii* Bleeker.

Locality: Goyaz.

12. *Pseudopimelodus acanthochirus* sp. nov.

Type, No. 8133, one specimen, .063 m. Gurupa.

Type, No. 8157, one specimen, .045 m. Tajapuru.

Type, No. 7732, two specimens, .093—.114 m. Tefé.

Collected by Professor Louis Agassiz.

Type, No. 7332, one specimen, .12 m. Jutahy.

Depth, behind the humeral process, less than the width, tapering to the caudal peduncle. Head depressed, as wide as long. Frontal fontanel not continued behind the eye; an elongate occipital fontanel. Occipital process short, but meeting the longer dorsal plate. Large round pores on the head, most numerous on the snout and chin.

Eye small, $2\frac{1}{2}$ in the snout, $8\frac{1}{2}$ in the head, 3 in the interorbital.

Barbels all short, those of the maxillaries extending about to middle of pectorals. Mouth more than half as wide as length of head; intermaxillary band of teeth with a sharp, backward projecting angle; mandibular band of teeth shallower than the intermaxillary band, about as deep as one diameter of the eye, scarcely widened in front.

Humeral process nearly horizontal, strong, triangular, not reaching middle of pectoral fin.

Distance of dorsal fin from tip of snout $2\frac{1}{3}$ in the length; the dorsal spine stout, toothed on its outer margin, 2 in head, the rays higher, nearly uniform. Distance of adipose fin from the dorsal more than the length of the dorsal fin; the adipose about as long as the dorsal fin.

Caudal fin long, scarcely shorter than the head, rounded.

Anal fin beginning and ending a little in advance of the anterior and posterior ends of the adipose; the tips of the anal rays reaching base of caudal fin when laid back.

Ventrals inserted under the vertical from last dorsal ray, $1\frac{1}{2}$ – $1\frac{3}{5}$ in the head.

Pectoral fin extending to the ventrals in young, much shorter in adult specimens, the spine $1\frac{1}{2}$ in head, little shorter than the longest ray, very much depressed, the teeth equally strong and long on both margins, those on the outer margin directed toward the tip, on the inner margin toward the base of the spine.

Abdominal region sometimes covered with small papillæ; anterior portion of the lateral line with larger papillæ or

short tentacles. Lateral line sometimes not extending to the caudal fin.

Chocolate color; head faintly marked with lighter; a zig-zag light bar from gill-openings across the nape; dorsal fin dark brown, a short, transparent bar on the lower half of the last four dorsal rays; base and posterior third of caudal fin dark brown, the intermediate region transparent with dark mottlings; anal dark brown, margined with white, and a white bar on lower half of the last five rays; ventral and pectoral fins dark brown.

Head $3\frac{1}{2}$; depth 5; Br. 8-9; D. I, 6; A. 10.

VI. RHAMDIA Bleeker.

Pteronotus Swainson; *Pimelonotus* Gill; ? *Notoglanis* Günther.

DOUBTFUL SPECIES.

I. *Pimelodus velifer* Humboldt; II. *Pimelodus argentinus* Humboldt; III. *Rhamdia laukidi* Schomburgk; IV. *Pimelodus grunniens* Humboldt.

§ Nov. ? Occipital process and fontanel none.

13. *Rhamdia breviceps* (Kner.)

§ *Rhamdia*.

14. *Rhamdia schomburgkii* Bleeker.

Pimelodus maculatus Schomburgk.

15. *Rhamdia bathyurus* Cope.

16. *Rhamdia obesa* sp. nov.

Type, No. 7518. Length .26 m. Teffé. L. Agassiz.

Occipital process present; fontanel not continued behind the eye; jaws equal; intermaxillary band of teeth of about equal depth throughout; no dark lateral band; pores on the head not aggregated; dorsal I, 6; maxillary barbels extending beyond middle of the adipose fin in the adult. Vent midway between the bases of the caudal and pectoral fins.

Body short and deep, its greatest width less than its greatest depth. Head short, its width $1\frac{1}{5}$ in its length, width, at the angle of the mouth, 2 in its length; the head flat above, covered with very thin skin, the surface of the bones deeply furrowed, striations radiating from the eyes and from the pit at the base of the occipital process. Fontanel a narrow fissure between the frontal bones. Occipital process very long, partly concealed under the skin, reaching more than half way to the dorsal spine to near the large, concealed, dorsal plate. Pores scattered over the head.

Eye round, $2\frac{1}{4}$ in snout, $6\frac{1}{4}$ in head, 2 in the interorbital; its posterior margin in front of the middle of the head.

Maxillary barbel (torn on one side) extending to tips of middle caudal rays; mental barbels reaching middle of pectoral, post-mental to midway between tip of pectoral and base of ventral.

Jaws equal, mouth comparatively small; teeth of the mandible as usual; the intermaxillary band of teeth shallowed and interrupted in the middle, its depth about 9 in its width, without backward projecting angles.

Gill-rakers 3+9.

Distance of dorsal spine from tip of snout $2\frac{2}{5}$ in the length; dorsal fin shorter than high, the highest ray $1\frac{2}{3}$ in the head. Distance of adipose fin from the dorsal equal to one-third the length of the latter fin; adipose fin twice as long as the dorsal fin, 3 in the length.

Caudal deeply cleft, the lobes longer than the head, about 3 in the length.

Anal fin short and high, its margin narrowly convex, its highest ray 2 in the head.

Ventrals inserted below the vertical from the last dorsal ray, $1\frac{4}{5}$ in head.

Pectoral spine strong, terete, short hooks on its outer margin near tip and short teeth nearly the entire length of the inner margin; $1\frac{1}{2}$ in the head.

A large, dark humeral spot; fins dusky, the usual pale bar on the dorsal fin near its base.

Head $3\frac{3}{4}$; depth, below dorsal spine, 5, above first anal ray $4\frac{1}{2}$; depth of caudal peduncle 8; Br. 7; D. I, 6; A. 10.

17. *Rhamdia sebæ* (Cuv. & Val.)

Pimelodus steglichii & *musculus* Müller & Troschel; *Pimelodus holomelas* & *mülleri* Günther.

Localities: Tonantins; Gurupa; Rio Janeiro; Bahia; Xingu; Santa Cruz; Cudajas; Sao Matheos; Rio Doce; Serpa; Tabatinga; Goyaz; Para; Teffé; Surinam; Villa Bella.

17. (a.) *Rhamdia sebæ kneri* (Steindachner.)

? ? *Pimelonotus wilsoni* Gill.

Localities: Tabatinga; Jutahy.

18. *Rhamdia foina* (Müller & Troschel.)

19. *Rhamdia humilis* (Günther.)

20. *Rhamdia cinerascens* (Günther.)

21. *Rhamdia pentlandi* (Cuv. & Val.)

22. *Rhamdia quelen* (Quoy & Gaimard.)

Pimelodus sellonis Müller & Troschel; ? *Pimelodus bahianus* Castelnau; *Silurus sapipoca* Natterer; *Pimelodus wuchereri* Günther; *Pimelodus queleni cuprea* Steindachner; *Pimelodus cuyabæ* Steindachner.

Localities: Santa Clara; Rio Mucuri; Juiz de Fora; Campos; Rio Jequitinhonha; Mendez; Rio de Janeiro; Macacos; Sao Matheos; Rio Parahyba; Cannavieiras; Rio Grande do Sul.

23. *Rhamdia multiradiatus* (Kner.)

Pimelodus arekaima Schomburgk descr. not plate.

24. *Rhamdia sapo* (Valenciennes.)

Locality: Rio Grande do Sul. Emperor's collection.

25. *Rhamdia hylarii* (Cuv. & Val.)

Locality: Bon Jardin, on the Rio San Francisco.

26. *Rhamdia wagneri* (Günther.)

Pimelodus cinerascens Kner & Steindachner (not Günther); *Rhamdia bransfordii* Gill.

Localities: Gorgona; Rio Chagres; Rio Obispo; Turbo, Atlantic Coast of Central America.

27. *Rhamdia longicauda* Boulenger.

28. *Rhamdia dorsalis* Gill.

29. *Rhamdia poeyi* sp. nov.

Type, one specimen. Length .175 m. (to base of caudal fin); Goyaz; Senhor Honorio.

Width of the body about equal to its depth; much compressed toward the caudal fin. Head short, flat above, the sides not very steep, the greatest width $1\frac{1}{4}$ in its length. Fontanel not continued behind the eyes. Occipital process very short, triangular, reaching two-sevenths the distance from its base to the dorsal spine. A few large pores about the head.

Eye 3 in snout, 7 in head, $1\frac{1}{2}$ in the interorbital.

Maxillary barbels scarcely reaching the vertical from the dorsal spine; post-mental barbels about reaching to the gill opening, the mentals less than half as long. Branchiostegal membranes separate to below the anterior part of the eyes. Gill-rakers 3+7.

Distance of dorsal spine from tip of snout less than 3 in the length. Distance of adipose fin from the dorsal fin equals the length of the dorsal; adipose fin very low in front, its base about $3\frac{1}{4}$ in the length.

Pectoral and ventral fins very short; pectoral spine short, terete, about half as long as the head, its outer margin smooth, the inner margin with strong teeth the entire length.

Color brown, the sides and back densely covered with small brown dots and more minute black dots; a dark humeral spot, a narrow dark lateral band.

Head $4\frac{1}{3}$; depth, above first anal ray, 7; depth of peduncle $9\frac{1}{2}$; Br. 6; D. I, 6; A. 13.

30. *Rhamdia tenella* sp. nov.

Type, No. 7547. Length .31 m. Cudajas.

Width behind the head equal to the depth, tapering to the strongly compressed, caudal peduncle. Head broad and flat transversely, its greatest width $1\frac{1}{3}$ in its length; profile regularly and strongly convex; width at angle of mouth 2 in length of head. Fontanel a narrow slit be-

tween the frontal bones. Occipital process extending a third of the space from its base to the dorsal spine.

Eye, 3 in snout, 9 in head, $2\frac{1}{2}$ in the interorbital.

Maxillary barbels reaching beyond the dorsal fin; mental barbels to base of pectorals, post-mentals to middle of pectorals.

Lower jaw shorter than the upper; intermaxillary band of teeth twice as deep at outer margins as at the middle; the greatest depth of the band $3\frac{1}{2}$ in its width.

Gill membranes separate to below angle of mouth; gill-rakers slightly branched, 3+10.

Distance of dorsal fin from tip of snout 3 in the length; dorsal rays of nearly uniform height, higher than the spine. Distance of the adipose from the dorsal fin 2 in the length of the dorsal fin, its distance from the caudal less than a diameter of the eye.

Caudal deeply forked, the lower lobe broader, rounded, $1\frac{1}{3}$ in head.

Anal longer than high, its longest ray $2\frac{1}{4}$ in head; tip of the anal fin not reaching the vertical from the end of the adipose by the length of the snout.

Ventrals inserted behind the vertical from last dorsal ray, 2 in head.

Pectoral spine very strong, scarcely shorter than the longest ray, recurved hooks on upper three-fourths of its outer margin; a deep groove almost the upper half of its inner margin, the basal third roughened; its length $1\frac{1}{3}$ in head.

Color brownish; fins dusky; adipose margined with black.

Head $4\frac{1}{4}$; depth $6\frac{3}{4}$; depth, above first anal ray, 8; depth of caudal peduncle 10; Br. 7-8; D. I, 6; A. 11.

§ *Rhamdella* subg. nov.

Type, *Rhamdia eriarcha*, nov.

Fontanel continued to the occiput, a bridge across it behind the orbit.

31. *Rhamdia microcephala* (Reinhardt).

32. *Rhamdia notata* (Schomburgk).

33. *Rhamdia eriarcha* sp. nov.

One specimen .26 m. in length. Dom Pedro. Rio Grande do Sul.

Body elongate, slender, the width below the dorsal spine less than the depth. Head long, pointed, entirely covered with skin; the fontanel continued to base of occipital process, which reaches about half way to dorsal spine; the head flattish above, snout long and pointed; the width at angle of mouth $2\frac{4}{5}$ in length of head.

Eye large, 2 in snout, $4\frac{1}{2}$ in head, its center about one-fourth nearer posterior margin of opercle than to tip of snout, the interorbital less than a diameter of the eye.

Maxillary barbels reaching posterior edge of opercle; post-mental barbels not to gill-opening if drawn horizontally backward.

Upper jaw produced; lips thick, strongly plicate; intermaxillary band of teeth deep and narrow, the teeth minute; no teeth on vomer or palatines; teeth of the mandible similar to those of the upper jaw, in a narrow band which tapers backward.

Gill-membranes separate to below center of eye; gill-rakers 1+5.

Distance of dorsal fin from tip of snout $2\frac{4}{5}$ in the length; first ray of dorsal scarcely spine-like, smooth, its height, including filament, $1\frac{3}{5}$ in length of head; highest ray $1\frac{2}{5}$ in head, higher than the length of the fin. Adipose fin $2\frac{4}{5}$ in the length, distant from the dorsal fin as far as the base of the dorsal fin is long.

Caudal forked to its base, the upper lobe greatly pro-

duced, much longer than the head (broken off in the specimen).

Anal long and low, the posterior rays highest, $2\frac{1}{2}$ in head, the tips not reaching as far as the end of the adipose by more than one diameter of eye.

Ventrals broad, reaching the anal, $1\frac{3}{5}$ in head.

Pectoral spine strong, both edges roughened, $1\frac{1}{5}$ in head, the longest rays $1\frac{1}{4}$ in head.

Color, chocolate above a black lateral band, much lighter below it; fins plain.

Head $4\frac{3}{4}$; depth 7; depth of caudal peduncle 14; D. I, 6; A. 15.

34. *Rhamdia exsudans* (Jenyns).

35.* *Rhamdia jenynsii* (Günther).

Pimelodus gracilis Jenyns (not Val.).

Locality: Maldonado.

*NOTE.—The following two species from Mexico are in the collection of the Museum of Comparative Zoölogy.

***Rhamdia Parryi* sp. nov.**

Types, No. 26292 a. Six specimens .093—.10 m. in length. Rio Zanaleño, near Tonalá, Chiapas, Mexico.

Related to *Rhamdia jenynsii* Günther.

Head conical, its width $1\frac{1}{4}$ in its length, its depth at base of occipital process $1\frac{1}{3}$ – $1\frac{1}{2}$; top of head entirely covered with thin skin; fontanel extending from in front of the eyes nearly to the base of the occipital process, separated into two parts by a narrow bridge opposite the posterior orbital rim; occipital process very narrow and short, the exposed portion as long as wide, extending backward, imbedded in the skin, one-third the distance from its base to the dorsal spine. Dorsal plate rather large, triangular, entirely hidden by skin, not articulating with the occipital process; space between anterior and posterior nasal openings equal to the diameter of the eye which is 2 in anteorbital, $1\frac{1}{2}$ in interocular, 5 in head.

Maxillary barbels short, extending to or beyond dorsal fin, mentals and post-mentals inserted in a nearly straight line, the former reaching edge of gill-opening, the post-mentals to base of pectoral.

Lower jaw entirely included; width of mouth $2\frac{2}{3}$ –3 in head; band of teeth of equal depth in both jaws, the intermaxillary band about 3 in head.

Dorsal spine $1\frac{2}{3}$ in head, equidistant from snout and first anal ray, highest

36. *Rhamdia minuta* Lütken.

Localities: Rio Janeiro; Macacos.

VII. PIMELODELLA gen. nov.***Pseudorhamdia* Steindachner (not Bleeker).**Type, *Pimelodus cristatus*.

Head entirely covered with skin; occipital process narrow, of the same width throughout, meeting the dorsal plate; fontanel prolonged backward to the occipital process with a bridge across it behind the eye.

ray $1\frac{2}{3}$ in head, the dorsal fin about one-third higher than long; distance between first dorsal and adipose fins greater than the length of the dorsal; adipose fin $3-3\frac{1}{2}$ in the length.

Caudal lobes short and broad, the lower one very broadly rounded, the upper slightly longer and more pointed, 4-5 in the length.

Anal rays short, more than two in head. Ventrals $1\frac{3}{4}$ in head.

Pectoral spine depressed, short and stout, slightly more than one-half the length of the head, with numerous straight teeth on the posterior margin to near the tip, the longest about one-third the width of the spine; recurved hooks on the anterior margin.

Pores on the chin and a few minute ones on head.

Color light chocolate; a well-defined black band along the sides, continued through the eye and around the snout; numerous dark points scattered over the body; a purplish area at base of dorsal; sometimes narrow vertical bars along each side of the dorsal rays; caudal dusky.

Head $4\frac{1}{3}-4\frac{1}{2}$; depth $4\frac{1}{3}-5$; Br. 6 or 7. D. I, 5-6; A. 12-14.

***Rhamdia petenensis* Günther.**

Pimelodus petenensis Günther, Cat. Fish. Brit. Mus. V. 126, 1864 (Lake Peten); id, Fish. Central America 393, 1866.

Three specimens: length .115—.125 m. Rio Zanaleneo, Chiapas, Mexico.

Body below the dorsal spine scarcely deeper than wide, tapering to the caudal peduncle; head little wider than the body, its greatest width $1\frac{1}{4}$ to $1\frac{1}{2}$ in its length; flattened above; the profile steep and little convex, not decurved at the snout; snout flat and broad, its width at the angle of the mouth $2-2\frac{1}{4}$ in the length of the head. Fontanel becoming very narrow behind the eye, continued to the base of the occipital process. Occipital process narrow, not reaching half way to the dorsal plate.

Eye small, round; little nearer tip of snout than to opercular margin; $2-2\frac{1}{2}$ in snout, 2 in interorbital, $6-6\frac{1}{2}$ in head.

Maxillary barbels reaching to end of dorsal or little beyond base of ven-

37. *Pimelodella cristatus* (Müller & Troschel).

Pimelodus insignis Schomburgk; description, not plate; *Pimelodus agasizii* Steindachner; *Pimelodus ophthalmicus* Cope.

Localities: San Gonçallo; Avary; Villa Bella; Jutahy; Topajos; Rio Mucuri; Tabatinga; Hyavary; Coary.

38. *Pimelodella wessellii* (Steindachner).

Localities: Cudajas; Para; Marajo; Rio Madeira; Rio Puty; Santarem.

39. *Pimelodella gracilis* (Valenciennes).

Locality: Goyaz.

40. *Pimelodella pectinifer* sp. nov.

Type, No. 7508; length .19 m. Campos. Hartt & Copeland.

Body robust, compressed posteriorly; head conical, its greatest width $1\frac{1}{3}$ in its length, its depth at base of occipital process equal to its width. Profile straight from dorsal to eyes, thence decurved forward; head convex transversely. Lateral margins of occipital process concave; distance from the anterior to the posterior nostril $1\frac{1}{3}$ in eye.

trals; mental barbels to base of pectoral, post-mental about to middle of pectorals.

Mouth wide, terminal, the lower jaw slightly the shorter; teeth of the upper jaw in a band of uniform depth, interrupted in the middle, its depth about 6 in its width.

Gill membranes separated by a deep notch; gill-rakers 2+6.

Distance of dorsal fin from snout $2\frac{3}{4}$ - $2\frac{1}{4}$ in the length; dorsal fin as long as high, its free margin rounded; highest dorsal ray $1\frac{3}{4}$ -2 in head; distance of the adipose from the dorsal fin equals the length of the dorsal; adipose fin $2\frac{3}{4}$ - $3\frac{1}{4}$ in the length.

Caudal divided to near its base, the lower lobe much the broader, rounded; the upper lobe pointed; the lobes about equal in length, $1\frac{1}{2}$ in head.

Anal short and high, about as high as long, 2 in head.

Ventrals inserted considerably behind the vertical from the last dorsal ray, about half as long as the head.

Pectoral spine strong, recurved teeth along its anterior margin, strongest near the tip; much weaker teeth along its posterior margin to near its tip, its length $2\frac{1}{2}$ - $2\frac{1}{5}$ in head; the longest ray $1\frac{3}{8}$ in head.

Body brownish, covered with numerous dark dots; lower part of cheeks and opercles similarly spotted; fins with small spots.

Head 4- $4\frac{1}{4}$; depth $5\frac{1}{5}$ - $6\frac{1}{2}$; depth of caudal peduncle 10; Br. 7; D. I, 6; A. 11-12.

Maxillary barbels not extending to the adipose fin; mental barbels reaching base, post-mentals to middle, of pectoral fins. Width of intermaxillary band of teeth 4 in length of head.

Eye $1\frac{1}{2}$ in snout, 4 in head, nearer posterior margin of opercle than to the tip of snout.

Gill-membranes separate to below anterior margin of the eyes. Humeral process extending to middle of pectoral spine.

Dorsal spine inserted nearer tip of snout than to origin of anal, its height $1\frac{1}{2}$ in head, the highest dorsal ray about equal to the length of the head. Adipose fin 4 in the length, its distance from the dorsal fin equals three-fifths of its own length.

Caudal fin about 4 in the length.

Anal fin convex, its highest ray $1\frac{3}{4}$ in head.

Ventrals inserted behind the vertical from last dorsal ray, not reaching the anal by one-third their length.

Pectoral spine 1 in length of head, the fin not reaching ventrals by one-half its length.

Color uniform light brownish.

Head $4\frac{3}{4}$; depth $5\frac{1}{2}$; Br. 6; D. I, 6; A. 12.

41. *Pimelodella modestus* (Günther).

42. *Pimelodella elongatus* (Günther).

43. *Pimelodella lateristriga* (Müller & Troschel).

Localities: Santa Clara; Rio Mucuri; Rio Doce; Cannavieras; Sao Matheos; Mendez; Rio Trombetas; Obidos; Iga.

44. *Pimelodella harttii* (Steindachner).

45. *Pimelodella buckleyi* (Boulenger).

Localities: Rio Parahyba; Macacos.

46. *Pimelodella vittata* (Kröyer).

Localities: Rio San Francisco; Minas Geraes; Sao Matheos; Rio Jequitinhonha.

47. *Pimelodella chagresi* (Steindachner).

Locality: Obispo River.

48. *Pimelodella brasiliensis* (Steindachner).

DOUBTFUL SPECIES OF *Pimelodella* OR OF *Pimelodus*.

- I. *Rhamdia cyanostigma* Cope. II. *Silurus quadrimaculatus* Bloch.

VIII. PIMELODUS Lacépède.

Pseudarioides & *Pseudorhamdia* Bleeker; *Pseudorhamdia* Lütken.

49. **Pimelodus eques** Müller & Troschel.
Localities: Amazon near Fonteboa; Teffé; Obidos; Villa Bella; Jose Fernandez; Xingu; Tonantins; Hytahy; Lake Hyanyary.
50. **Pimelodus ornatus** Kner.
Silurus megacephalus Natterer.
Locality: Goyaz.
51. **Pimelodus albicans** (Cuv. & Val.)
Arius albidus Val.; *Arius mroti* Val. fide Günther.
Locality: Rio Plata.
52. **Pimelodus pictus** Steindachner.
Locality: Hyavary.
53. **Pimelodus clarias** (Bloch.)
Pimelodus maculatus Lacépède; *Pimelodus rigidus* Spix; *Pimelodus blochii* Cuv. & Val.; *Pimelodus arekaima* Schomburgk (plate, not description); *Mystus ascita* Gronow; *Pimelodus macronema* Bleeker; *Pseudarioides albicans* Lütken; ? *Pseudarioides pantherinus* Lütken; *Pseudorhamdia piscatrix* Cope; *Piraputana macrospila* Günther.
Localities: I. var. (?) *maculatus*, Rio das Velhas; Uruguay; Jequitinhonha; Rio Grande; Goyaz.
II. vars. (?) *macrospila*, *arekaima*, *piscatrix*, and nov., Para; Porto do Moz; Santarem; Obidos; Villa Bella; Coary; Teffé; Fonte Boa; Tabatinga; Hyavary; Cudajas; Rio Gongallo; Montalegre; Rio Reto; Rio Puty; Manacapuru; Tonantins; Lago Alexo; Cameta.
III. var. (?) nov., Rio San Francisco.
IV. var. (?) nov., Avary; Para; Iga; San Gongallo; Jutahy; Rio Puty.
V. var. (?) *macronema*, Amazon.
We have repeatedly examined and compared the 300 or more specimens in the collection, and can come to no other conclusion than that the many synonyms given here all refer to this extraordinarily variable species.
54. **Pimelodus grosskopfii** Steindachner.

55. *Pimelodus labrosus* Kröyer.
 56. *Pimelodus valenciennis* Kröyer.
 57. *Pimelodus westermanni* Reinhardt.
 58. *Pimelodus altipinnis* Steindachner.
 Locality: Para.
 59. *Pimelodus fur* Reinhardt.
 Pimelodus microstomus Steindachner.
 Localities: Rio das Velhas; Giquitiba; Rio San Francisco.

IX. GEN. NOV. ?

Head behind the eyes granulated; fontanel not extending behind the eyes; occipital process not reaching the dorsal plate. Barbels compressed, ribbon-like.

60. *Pirinampus* (?) *agassizii* Steindachner.

X. CONORHYNCHOS Bleeker.

§ *Conorhynchos*.

61. *Conorhynchos conirostris* (Cuv. & Val.)

§ *Nov.* ?

62. *Conorhynchos glaber* Steindachner.

XI. BAGROPSIS Lütken.

63. *Bagropsis reinhardti* Lütken.

XII. PIRAMUTANA Bleeker.

64. *Piramutana piramuta* (Kuer.)

XIII. PLATYNEMATICHTHYS Bleeker.

65. *Platynematichtys punctulatus* (Kuer.)

Bagrus nigripunctatus Kuer.

66. *Platynematichtys araguayensis* (Castelnau.)

XIV. PHRACTOCEPHALUS Agassiz.

67. *Phractocephalus hemiliopterus* (Bloch & Schneider.)

Phractocephalus bicolor Agassiz.

Localities: Xingu; Coary; Teffé; Manacapuru; Obidos; Lake Hy-anuary.

XV. SCIADES Müller & Troschel.

Leiarius and *Sciadeichthys* Bleeker.‡ *Sciades*.68. *Sciades pictus* Müller & Troschel.*Arius longibarbis* Castelnau.

Localities: Rio Negro; Villa Bella.

§ *Sciadeoides* nov.

Surface of the head and occipital process entirely covered with thick skin. Head little longer than broad.

69. *Sciades marmoratus* Gill.

Locality: Tabatinga.

XVI. BRACHYPLATYSTOMA Bleeker.

Piratinga and *Malacobagrus* Bleeker.70. *Brachyplatystoma filamentosum* (Lichtenstein.)71. *Brachyplatystoma vaillanti* (Cuv. & Val.)*Platystoma affine* Cuv. & Val). *Platystoma mucosa* Vaillant. = *Platystoma verrucosum* Boulenger.

Localities: Tabatinga; Para; Porto do Moz; Avaré; Rio Paty; Juiz de Fora on the Parahyba.

72. *Brachyplatystoma reticulata* (Kner.)73. *Brachyplatystoma rousseauxii* (Castelnau.)*Bagrus goliath* Heckel.

Locality: Para.

XVII. DUOPALATINUS gen. nov.

Head narrow, little depressed, the width of the snout $1\frac{1}{2}$ in the greatest width of the head. Upper jaw little longer than the lower. Teeth all alike, the vomerine patches far removed from the palatine patches. Adipose fin twice as long as anal.

This genus is most nearly related to *Brachyplatystoma* in which the teeth of the inner series of the intermaxillaries are long, slender and depressible; of the outer series short, recurved and fixed.

74. *Duopalatinus emarginatus* (Cuv. & Val.)

Localities: Rio San Francisco; Rio das Velhas.

XVIII. STEINDACHNERIA gen. nov.Type, *Steindachneria amblyurus* nov.

No teeth on the palate; teeth on the vomer in one or two patches; no dermal ossifications about the head; adipose fin much longer than anal.

75. *Steindachneria amblyurus* sp. nov.*Platystoma parahybæ* Steindachner (in part.)

Types, No. 7324, 2 specimens; .35 and .38 m. long. Jequitinhonha. Hartt & Copeland.

Body slender. Head much depressed, its width at the angle of the mouth is two-thirds of the greatest width of the head which equals its length.

Eye 3 in snout, $8\frac{1}{2}$ in head, $3\frac{1}{2}$ in interocular.

Maxillary barbels extending to the adipose fin.

Teeth on the vomer in two patches.

Dorsal spine slender, $2\frac{1}{2}$ –3 in head, the rays $1\frac{3}{4}$ to 2. Base of the adipose fin almost twice as long as the base of the anal. Pectoral spine 2 in head; its outer margin roughened, its inner margin with sharp teeth. Caudal fin broadly rounded.

Upper parts brownish, marked with round spots which are smallest on the head, sometimes confluent into vermiculations; adipose and caudal fins with spots; membrane of dorsal fin sometimes with a vertical series of spots; other fins dusky.

Head 4; Depth $7\frac{1}{3}$; Br. 9 or 10; D. I, 6; A. 12.

S. parahybæ has the caudal deeply lobed, D. I, 7.

76. *Steindachneria parahybæ* (Steindachner.)

Locality: Rio Parahyba near Juiz de Fora. Types.

XIX. Gen. nov. ?

Palatine teeth present, forming, with the vomerine teeth, a narrow uninterrupted band.

77. *Platystoma lütkeni* Steindachner.

XX. HEMISORUBIM Bleeker.

78. *Hemisorubim platyrhynchos* (Cuv. & Val.)

Localities: Manacapuru; Rio Negro; Montalegre; Rio Puty; Lago Alexo; Obidos; Coary; Tabatinga; Hyavary; Tonantins; Sao Paulo.

XXI. PSEUDOPLATYSTOMA Bleeker.

Hemiplatystoma Bleeker.79. *Pseudoplatystoma fasciatum* (Linnaeus) (in part.)

? *Platystoma truncatum* Agassiz; *Platystoma punctifer* Castelnau.

Localities: Obidos; Coary; Hyavary.

79 (a). *Pseudoplatystoma fasciatum intermedium* var. nov.

Type, No. 7321, one specimen, .42 m. long. Obidos.

Maxillary barbels not reaching to the dorsal, mental barbel not to the pectoral, post-mentals to middle of pectorals. Vomerine teeth narrowly joined.

Lower parts white, upper parts brownish, with numerous narrow, dark wavy lines extending to the edge of the belly; dorsal, pectoral and ventral fins plain yellow; caudal with round brown spots, the anal with a very faint dusky spot at the base of the last rays and an obscure streak on the tip of the rays; head with small round brown spots.

79 (b). *Pseudoplatystoma fasciatum tigrinum* (Cuv. & Val.)

Locality: Obidos.

80. *Pseudoplatystoma coruscans* (Agassiz.)

Sorubim caparary Spix; *Platystoma pardalis* Valenciennes; *Platystoma punctatum* Cuv. & Val.; *Platystoma orbignianum* Valenciennes; *Platystoma forschhammeri* Reinhardt.

Localities: Manaus; Rio das Velhas; Rio San Francisco, below the falls.

XXII. SORUBIM Spix.

Platystoma Agassiz (name preoccupied in Diptera.)81. *Sorubim lima* (Bloch & Schneider.)

Sorubim infraocularis Spix; *Platystoma luceri* Weyenbergh.

Localities: Manacapuru; San Paulo; Fonteboa; Tabatinga; Hyavary; Tefé; Obidos; Marañon; Ucayale; Iça; Lago do Manimo; Para; Rio Puty; Jutahy.

XXIII. SORUBIMICHTHYS Bleeker.

82. *Sorubimichthys planiceps* (Agassiz.)
Sorubim pirauca Spix; *Platystoma artedii* Günther; *Sorubimichthys ortonii* Gill.
 Localities: Manacapuru; Hyavary; Teffé.
83. *Sorubimichthys spatula* (Agassiz.)
Sorubim jandia Spix.
84. *Sorubimichthys gigas* (Günther.)

XXIV. PLATYSTOMATICHTHYS Bleeker.

85. *Platystomatichtys sturio* (Kner.)
 Localities: Para; Curuca; Rio Muria.

DOUBTFUL SPECIES. Genus ?

- I. *Bagrus flavicans* Castelnau. II. *Bagrus punctulatus* id.

XXV. TACHISURUS Lacépède.

Bagrus, *Galeichthys*, *Arius* Cuv. & Val.; *Arius* Bleeker; *Sciades* Müller & Troschel; *Sciades* Bleeker 1863, not 1858; *Ariodes* Müller & Troschel; *Hexanematichtys*, *Cephalocassis* Netuma, *Guiratinga*, *Sciadeichthys* 1858, not 1863, *Selenaspis*, *Hemiaris*, *Pseularius* Bleeker; *Leptarius*, *Notarius*, Gill; *Cathorops* Jordan & Gilbert.

DOUBTFUL SPECIES.

- I. *Arius nigricans* Valenciennes; II. *Arius obesus* Schomburgk.

 $\frac{1}{2}$ *Galeichthys*.

86. *Tachisurus lentiginosus* sp. nov.
 Types, No. 4970, two specimens, each .39 m. long. Panama. Steindachner.

Body nearly terete anteriorly, becoming compressed backward, the width above the pectorals a little greater than the depth. Head flat, depressed, its depth at base of occipital process $1\frac{1}{6}$ in its greatest width, which is about $1\frac{1}{4}$ in its length. Occipital process somewhat roughened, about

twice as long as its greatest width, its margins straight and oblique; the middle of the fontanel above the posterior part of the eye. Head everywhere covered with skin; sides of the head and opercle with vermiculating canals.

Eye $2\frac{1}{2}$ in snout, $8\frac{1}{2}$ in head, $4\frac{1}{2}$ in interocular, $2\frac{1}{4}$ in interorbital.

Snout somewhat pointed; upper jaw very little projecting; lips thick, teeth all villiform, the intermaxillary band strongly curved. Vomerine teeth in two oval patches, joined to the larger patches of the palatines. Mandibular bands separate in front; the outer margins, if continued forward, forming an angle at the symphysis.

Maxillary barbels reaching beyond base of pectorals; mental barbels reaching about $\frac{3}{5}$ toward the gill opening, the post-mentals to the gill opening.

Gill membrane forming a broad free margin across the isthmus. Gill rakers 3 + 4. Pectoral pore minute. Humeral process pointed behind.

Distance of the dorsal from the snout $2\frac{1}{5}$ in the length. The dorsal spine covered with a membrane, its outer margin granular; its height $1\frac{3}{5}$ in the head, the first soft ray $1\frac{3}{5}$ the length of the fin. Distance of adipose fin from the dorsal $3\frac{3}{5}$ -4 in the length, the fin adnate, longer than the dorsal.

Caudal lunate, the upper lobe longer, somewhat falcate, $4\frac{1}{2}$ -5 in the length.

Anal fin twice as long as high, the highest ray $2-2\frac{1}{4}$ in the head.

Ventrals short and broad, $1\frac{1}{5}$ in the head. Pectoral spine covered with a membrane, $1\frac{1}{2}$ - $1\frac{2}{5}$ in head.

Light brown, becoming nearly white below, the sides freckled; fins reddish.

Head $4-4\frac{1}{5}$; depth 5-6; D. I, 6; A. 22.

87. *Tachisurus peruvianus* (Lütken).

Locality: Callao.

§ *Sciadeichthys*.

88. *Tachisurus flavescens* (Cuv. & Val.)
 89. *Tachisurus temminkianus* (Cuv. & Val.)
 90. *Tachisurus emphysetus* (Müller & Troschel).
 91. *Tachisurus brandti* (Steindachner).
 ? *Sciades troschelii* Gill.
 Locality: Panama.
 92. *Tachisurus mesops* (Cuv. & Val.)
 93. *Tachisurus proops* (Cuv. & Val.)
 Locality: Pernambuco.
 94. *Tachisurus passany* (Cuv. & Val.)
 95. *Tachisurus albicans* (Cuv. & Val.)
 Bagrus valenciennesi Castelnau; *Arius valenciennesii* Günther.

§ *Selenaspis*.

96. *Tachisurus herzbergii* (Bloch).
 Pimelodus argenteus Lacépède; *Bagrus pemecus* Cuv. & Val.; *Bagrus caelestinus* Müller & Troschel; *Bagrus mesops* Kner (not C. & V.);
 Hexanemutichthys hymenorhinus Bleeker.
 Localities: Para; Curuca; Bahia.
 97. *Tachisurus dowii* (Gill).
 Arius alutus Steindachner.
 Locality: Panama.

§ ?.

98. *Tachisurus luniscutis* (Cuv. & Val.)
 Localities: Porto Alegre; Bahia; Nazareth, near Bahia; Rio Janeiro;
 Para; Porto Seguro; Sao Matheos; Cannavieras.
 99. *Tachisurus parkeri* (Traill).
 Arius quadriscutis Bleeker.

§ *Notarius*.

100. *Tachisurus grandicassis* (Cuv. & Val.)
 Localities: Maranhao; Bahia.
 100a. *Tachisurus grandicassis parmocassis* (Cuv. & Val.)
 Localities: Bahia; Sao Matheos; Maranhao.
 100b. *Tachisurus grandicassis stricticassis* (Cuv. & Val.)
 Localities: Bahia; Maranhao.

§ *Netuma*.

101. *Tachisurus dubius* (Bleeker).
 102. *Tachisurus kessleri* (Steindachner).
 Locality: Panama.
 103. *Tachisurus insculptus* (Jordan & Gilbert).
 104. *Tachisurus planiceps* (Steindachner).
 105. *Tachisurus platypogon* (Günther).
 Localities: Panama; Acapulco; ? Goyaz.
 106. *Tachisurus osculus* (Jordan & Gilbert).
 Locality: Panama.
 107. *Tachisurus elatturus* (Jordan & Gilbert).
 108. *Tachisurus barbatus* (Lacépède).
Pimelodus commersoni Lacépède; *Bagrus barbatus* Quoy & Gaimard;
Pimelodus versicolor Castelnau.
 Localities: Campos; Rio Doce; Rio Grande do Sul.

‡ *Hexanematichthys*.

109. *Tachisurus seemani* (Günther).
 ? ? *Arius assimilis* Jordan & Gilbert (not Günther).
 Locality: Panama.
 110. *Tachisurus jordani* sp. nov.
 ? *Arius assimilis* Jordan & Gilbert (not Günther).
 Types, No. 4945. Two specimens, ♂; length .256-.26 m. Panama.

Rather robust, the width little less than the depth; caudal peduncle compressed. Head heavy, little broader than high, its height $1\frac{1}{2}$ in its length, its width $1\frac{2}{5}$ - $1\frac{1}{3}$, its width at angle of mouth 2 - $2\frac{1}{4}$. Interorbital area flat and smooth; posterior portion of the head finely and sparsely granular; opercle and humeral process smooth. Occipital process about as long as broad, unusually sharply keeled. Fontanel extending to above posterior part of eye, continued as a deep groove to base of occipital process.

Eye large, $1\frac{3}{4}$ in snout, $5\frac{1}{2}$ in head, 2 in interorbital, $2\frac{3}{4}$ -3 in interocular.

Maxillary barbels extending to the pectoral pore, post-mental at least to the gill-opening, mental about three-fifths as long as the post-mental barbels.

Snout blunt, decurved; upper jaw a little produced. Teeth all villiform, those on the vomer forming two small, separate, ovate patches which are contiguous to the twice or thrice as large palatine patches.

Gill-membranes forming a fold across the isthmus. Gill-rakers $6 + 9$.

Pectoral pore large; vertical series of pores on the sides.

Distance of dorsal spine from the snout $2\frac{2}{5}$ – $2\frac{4}{5}$ in the length; the spine of the dorsal and pectoral fins granular on the basal half of their outer margins; the inner margins serrate almost their entire length; the spines equally long $1\frac{1}{2}$ in head. Distance of adipose fin from the dorsal $3\frac{2}{5}$ in the length, the adipose more than half as long as the dorsal fin, its posterior margin free.

Caudal deeply forked, the upper lobe longer, somewhat falcate, $3\frac{3}{4}$ –4 in the length.

Anal fin about as long as high, deeply emarginate, its highest ray $2\frac{2}{5}$ in the head.

Ventral fins not reaching the anal, 2 in the head.

Top of head and dorsal surface dark blue with metallic lustre, becoming silvery below; lower caudal lobe dusky; basal half of the inner surface of the paired fins black.

Head $3\frac{2}{5}$ – $3\frac{3}{5}$; depth $5\frac{1}{2}$ – $5\frac{5}{6}$; D. I, 7; A. 18.

111. *Tachisurus coerulescens* (Günther).

112. *Tachisurus guatemalensis* (Günther).

113. *Tachisurus assimilis* (Günther).

114. *Tachisurus surinamensis* (Bleeker).

115. *Tachisurus dasycephalus* (Günther).

116. *Tachisurus longicephalus* sp. nov.

Type, No! 4972. One specimen, ♂; length .29 m. Panama. Steindachner.

Elongate, slender; greatest width little greater than depth. Head long and depressed, its greatest width $1\frac{1}{2}$ in its length, its greatest depth little more than half its length. Top of head obscurely granular, the granules almost entirely concealed by the skin; interorbital area flat and with

four ridges which are obscurely granular, the inner two bordering the fontanel, the outer ridges curved in front, extending obliquely backward from near posterior nasal openings; occipital process as long as broad, its margins concave; fontanel continued as a deep groove to base of occipital process; opercle faintly striate; humeral process entirely covered with thick skin, not granular.

Eye lateral, but well above angle of mouth, its diameter $1\frac{1}{2}$ in snout, 6 in head, 3 in interocular. Snout depressed, rounded in front.

Maxillary barbels extending scarcely beyond base of pectorals; mentals not reaching gill-opening.

Upper jaw little projecting; width of mouth $2\frac{1}{5}$ in head. Intermaxillary teeth long and slender, the depth of the band $4\frac{1}{3}$ in its width; vomerine and palatine teeth obtusely conical, the vomerine patches separate, contiguous to, but not confluent with the palatine patches.

Gill-membranes not forming an angle where they meet, with a rather broad, free margin. Gill-rakers short and thick, $4+5$.

Pectoral pore small; vertical series of pores on the sides.

Distance of dorsal fin from snout $2\frac{3}{5}$ in the length, the spine $1\frac{3}{4}$ in head, its outer margin with granular teeth near its base, its inner margin with short teeth. Distance of adipose fin from the dorsal, $3\frac{1}{6}$ in the length. Adipose fin much longer than high, as long as the dorsal fin.

Caudal fin forked, the upper lobe one-third longer than the lower, very nearly as long as the head, $3\frac{4}{5}$ in the length.

Anal fin emarginate, scarcely longer than high, its height $2\frac{1}{3}$ in the head.

Ventrals reaching almost to the anal, about 2 in head.

Pectoral spine a little longer than the dorsal spine, $1\frac{1}{3}$ in the head; its outer edge roughened, inner edge with rather sharp teeth.

Color: brown above, sides silvery; entire under surface

sprinkled with brown dots; a black median line on the back; fins dusky; barbels blackish.

Head $3\frac{3}{5}$; depth $6\frac{1}{2}$; D. I, 7; A. 20.

117. *Tachisurus rugispinis* (Cuv. & Val.)

Locality: Para.

118. *Tachisurus phrygiatus* (Cuv. & Val.)

Arius dierperinki Bleeker.

Locality: Maranhao.

119. *Tachisurus grandoculis* Steindachner.

Locality: Rio Doce.

2 Tachisurus.

120 *Tachisurus nuchalis* (Günther.)

121. *Tachisurus agassizii* sp. nov.

Type, No. 7670, one specimen; length .235 m. Rio Grande do Sul. Senhor Albuquerque.

Body compressed, especially backward, the depth greater than the width. Head narrowed forward, its greatest width $1\frac{1}{2}$ in its length, its greatest depth about $1\frac{1}{3}$; width at the mouth $2\frac{1}{4}$ in the length of the head. Top of head granular, the granulations forming striæ nearly everywhere; occipital process as broad as long, with a median ridge, the margins concave. Middle of the fontanel over the posterior margin of the pupil, continued backward as a triangular groove to near base of occipital process; interorbital area with the usual four smooth ridges; humeral process roughened, covered with skin; sides of the head with reticulating mucous canals.

Eye $1\frac{1}{2}$ in snout, $5\frac{1}{3}$ in head, about 3 in interocular, 2 in interorbital space.

Maxillary barbels about reaching gill opening; mentals extending about half way to gill opening, the post mentals not much longer.

Upper jaw projecting; teeth villiform in the jaws, subgranular or bluntly conical on the palate, small; *no granular teeth in the inner series of the mandible*; the palatine patches smaller and more diverging than in *spixii*.

Gill-rakers united, joined to the isthmus. Gill-rakers 8 + 14.

Pectoral pore moderate.

Distance of dorsal spine from snout $2\frac{1}{2}$ in the length, the spine $1\frac{1}{2}$ in head, serrate on its posterior margin, granulate in front along basal half, becoming nearly smooth above.

Space between dorsal and adipose fins $3\frac{1}{2}$ in the length, the adipose shorter than the dorsal fin, free posteriorly.

Caudal forked, $4\frac{2}{5}$ in the length.

Anal fin a little longer than high, its highest rays about half length of head.

Ventral fins about 2 in the head.

Pectoral spine as long as the dorsal spine, but stronger, serrate on its inner margin, granular along its outer margin.

Dorsal surface brown; sides and ventral surface silvery; fins smutty.

Head $3\frac{1}{2}$; depth 5; D. I, 6; A. 19.

122. *Tachisurus fissus* (Cuv. & Val.)

? *Arius puncticulatus* Cuv. & Val.

123. *Tachisurus melanopus* (Günther.)

124. *Tachisurus spixii* (Agassiz.)

Pimelodus albidus Spix; *Arius arenatus* Cuv. & Val.; *Arius laticeps* Günther.

Localities: Maranhao; Bahia; Rio Janeiro; Para; Santos in Sao Paulo; Abrolhos.

125. *Tachisurus fürthii* (Steindachner.)

Locality: Panama.

126. *Tachisurus variolosus* (Cuv. & Val.)

127. *Tachisurus multiradiatus* (Günther.)

Bagrus? *arioides* Kner (not *B. arioides* C. & V.)

§ *Cathorops*.

128. *Tachisurus hypophthalmus* (Steindachner.)

129. *Tachisurus gulosus* sp. nov.

Two specimens, ♂; length .285—, .29 m. Panama. Steindachner.

Elongate, slender, the width scarcely less than the depth. Head broad, strongly depressed, the profile to tip of snout nearly straight; greatest width of head $1\frac{1}{2}$ in its length, its depth at base of occipital process about 2. Occipital process about as broad as long, obtusely keeled. Fontanel very narrow, its center above the posterior margin of the eye, continued backward as a groove. Top of head rugose posteriorly. Four bony ridges between the eyes, the inner two margining the fontanel, the outer extending obliquely backward from near the posterior nostrils; sides of head and snout with reticulating canals.

Eye oblique, its center over the posterior end of the mandible and about on a level with the rictus, its diameter $2\frac{1}{2}$ in snout, 8 in head, 5 in the interocular distance.

Maxillary and post-mental barbels reaching to the middle of the pectoral fins or shorter; mental barbels to near base of pectoral.

Jaws sub-equal, very thin; intermaxillary band of teeth very shallow in the middle; no teeth on the vomer; the space between the palatine patches equals $1\frac{1}{2}$ diameters of the eye, the teeth obtusely conical, in about three series in front, in a single series behind; mandibular band of teeth little more shallow than the intermaxillary band.

Gill membranes united and having a free margin. Gill-rakers $1\frac{1}{2}$ times as long as the eye, 12+30.

Pectoral pore large; vertical series of pores on sides of the body conspicuous.

Distance of dorsal fin from snout $2\frac{1}{3}$ in the length; dorsal spine rather slender, high, $1\frac{1}{3}$ in head; distance of adipose fin from the dorsal $3\frac{1}{2}$ in the length; adipose fin as high as as long, its posterior margin wholly free.

Lower caudal lobe somewhat the broader, the upper lobe $1\frac{3}{5}$ - $1\frac{4}{5}$ in the head.

Anal fin emarginate, the highest ray $2\frac{3}{4}$ in the head.

Ventral fins truncate, $2\frac{2}{5}$ - $2\frac{4}{5}$ in the head.

Pectoral spine $1\frac{3}{5}$ in the head, its outer margin roughened; its inner margin with recurved teeth.

Color: bluish-gray above, silvery below; dorsal and caudal slightly dusky, other fins plain; barbels dusky.

Head $3\frac{1}{4}$; depth $5\frac{1}{2}$ – $5\frac{3}{4}$; Br. 5; D. I, 7; A. 23.

This species is very closely related to *Arius hypophthalmus* Steindl. The differences are chiefly these:

<i>hypophthalmus.</i>	<i>gulosus.</i>
Intermaxillary band of teeth six times as wide as deep.	Intermaxillary band of teeth ten times as wide as deep.
Palatine patches of teeth considerably deeper than the intermaxillary band, twice as wide as deep, the distance between them $\frac{1}{2}$ (1 J. & G.) diameters of the eye.	Palatine patches of teeth $\frac{1}{2}$ as wide as the intermaxillary band, four times as wide as deep, the distance between them $1\frac{1}{2}$ diameters of the eye.
Snout $3\frac{3}{8}$ in the head.	Snout $3\frac{1}{2}$ in the head.

XXVI. GENIDENS Castelnau.

130. *Genidens genidens* (Cuv & Val.)

Genidens cuvieri & *granulosus* Castelnau; *Rhamdia lukidi* Bleeker (in part).

Localities: Porto Alegre; Santos; Rio Janeiro; Rio Sao Matheos; Rio Grande do Sul.

XXVII. AILURICHTHYS Baird & Girard.

Pimelodus Bleeker, Silures de Suriname 65, 1864.

131. *Ailurichthys panamensis* Gill.

Aelurichthys nuchalis Günther.

Locality: Panama.

132. *Ailurichthys bagre* (Linnæus).

Galeichthys gronovii & *eiduxii* Cuv. & Val.; *Bagrus micronemus* Ranzani; *Mystus carolinensis* Gronow; *Pimelodus longifilis* Mus. L. B. (fide Bleeker).

Localities: Sao Matheos; Santos; Para; Curuca; Pernambuco; British Guiana; Bahia.

133. *Ailurichthys pinnimaculatus* Steindachner.

Locality: Panama.

134. *Ailurichthys marinus* (Mitchill).

Silurus bagre (Bloch, not of Linnæus); *Felichthys filamentosus* Swainson; *Galeichthys parrae* Cuv. & Val.; *Galeichthys blochii* Cuv. & Val.; *Galeichthys bahiensis* Castelnau; *Aelurichthys longispinis* Günther.

Localities: Rio de Janeiro; Para; Bay of Balaxy; Mobile Bay; Pernambuco; Victoria, Brazil.

XXVIII. PARADIPLOMYSTES Bleeker.

Paradiplomystax Günther.

- 135.
- Paradiplomystes coruscans*
- (Lichtenstein).

XXIX. DIPLOMYSTES Bleeker.

Diplomystax Günther.

- 136.
- Diplomystes papillosus*
- (Cuv. & Val.)

?? *Silurus chilensis* Linnæus; *Arius carcharias* Leyboldt; *A. villosus*, *squalus*, *micropterus* and *synodon* Philippi.

Locality: Rivers of Santiago.

XXX. AGENEIOSUS Lacépède.

Ceratorhynchus Agassiz; *Hypothalmus* Schomburgk; *Pseudogeneiosus* & *Davalla* Bleeker; *Ageniosus* Günther.

- 137.
- Ageneiosus inermis*
- (Bloch).

♀ *Ageneiosus*.

- 138.
- Ageneiosus brevis*
- Steindachner.

Locality: Coary.

- 139.
- Ageneiosus atronasus*
- sp. nov.

One specimen; length .095 m. Exact locality unknown.

Body as broad as deep under the dorsal spine. Head short, depressed, not much elevated behind the eyes, the profile nearly straight, much less steep than in *brevis*, the head covered with thin skin, the surface of the bones longitudinally ridged; greatest width of the head $1\frac{1}{3}$ in its length, width at rictus $1\frac{1}{2}$; snout as in *brevis*, broadly rounded in front. Fontanel short, ending over center of eye, but continuing as a groove backward to the posterior margin of the eye. Occipital process scarcely as long as its basal width, coössified with the dorsal plate, its surface ridges somewhat granular.

Eye 1 in snout, $3\frac{1}{3}$ in head, 2 in the interocular.

Maxillary barbel bony at base, the bony portion being two-thirds of the whole length of the barbel, extending beyond the rictus half the total length of the barbel, its lower edge very minutely crenulate near its tip.

Snout short, as in *brevis*, about 2 in the interocular width. Upper jaw everywhere narrowly projecting, the intermaxillary band of teeth about as in *brevis*.

Lateral line zig-zag, with branches extending from the angles.

Distance of dorsal fin from the snout $2\frac{2}{3}$ in the length; the dorsal spine $1\frac{1}{3}$ in the head, roughened in front; short teeth on its inner margin except near base. Distance between the dorsal and adipose fins $2\frac{1}{2}$ in the length; adipose fin high and short.

Caudal forked, the lobes pointed, 1 in the head.

Origin of anal three-fifths nearer base of caudal than to the rictus.

Ventrals reaching the anal, $1\frac{4}{5}$ in head.

Pectoral spine $1\frac{1}{2}$ in head, otherwise like that of *brevis*.

Color, purplish on the back; head dotted above and below with purple; upper lip dark purple, the lower lip with a very narrow purple margin; a rather obscure lateral band formed of dark dots; minute punctulations above the anal fin; all the fins more or less dotted with purplish, the caudal narrowly edged with that color.

Head $3\frac{3}{5}$; depth, below dorsal 6, above anal 5; D. I, 6; A. 30.

140. **Ageneiosus valenciennesi** Bleeker.

Locality: Rio Puty.

141. **Ageneiosus armatus** Lacépède.

142. **Ageneiosus ucayalensis** Castelnau.

Locality: Para.

143. **Ageneiosus dentatus** Kner.

Ageneiosus pardalis Lütken.

Localities: Teffé; Para; Cameta.

144. **Ageneiosus porphyreus** Cope.

145. **Ageneiosus dawalla** (Schomburgk).

Ageneiosus inermis Cuv. & Val., not of Bloch; *Ageneiosus sebae* Günther.

§ *Pseudogeneiosus*.

146. **Ageneiosus brevifilis** Cuv. & Val.

Locality: Serpa.

147. *Ageneiosus axillaris* Günther.

XXXI. TETRANEMATICHTHYS Bleeker.

148. *Tetranematichthys quadrifilis* (Kner.)

XXXII. AUCHENIPTERUS Cuv. & Val.

Euanemus Müller & Troschel.149. *Auchenipterus nuchalis* (Spix.)

Auchenipterus dentatus Cuv. & Val.; *Euanemus colymbetes* Müller & Troschel.

Locality: Villa Bella. ?

150. *Auchenipterus fordicei* sp. nov.

Type, No. 7289, one specimen, length .12 m. Coary. L. Agassiz.

Body short, deep, compressed. Head short; its width equals the distance from tip of snout to middle of opercle; its depth at base of occipital process is little less than its width; top of the head covered with very thin skin, the surface of the bones striate. Occipital process twice as broad as long, parabolic behind, joining the dorsal plate: dorsal plate deeply emarginate in front and behind, less so on sides, its length on a median line $2\frac{1}{2}$ in the diameter of the eye.

Eye 1 in snout, $3\frac{1}{5}$ in the head, $2\frac{1}{3}$ in the interocular space.

Maxillary barbel reaching beyond base of ventrals, its osseous base not extending to center of eye; mental barbels reaching to the middle of the ventrals; post-mentals not to the middle of the pectorals. Snout rounded in front; jaws about equal, the width of the mouth at the rictus $1\frac{3}{5}$ in the width of the snout at the same place. Teeth as in *E. nuchalis*.

Distance of dorsal fin from tip of snout $3\frac{1}{2}$ in the length; dorsal spine $1\frac{1}{4}$ in head, slender, its anterior margin smooth, its posterior margin with short teeth, the tip of the spine, when depressed, reaching the vertical from the end of the first third of the ventral fins.

Caudal fin $4\frac{2}{5}$ in the length.

Origin of anal equidistant between snout and base of caudal.

Ventral fins large, one-sixth longer than the head, the inner rays connected by a membrane, the tips of the longest rays extending to the 8th or 9th anal ray.

Pectoral spine long and slender, 1 in head, curved, reaching a little beyond origin of ventrals, the outer edge of the spine smooth, the inner with sharp, recurved teeth. Pectoral pore large.

Color nearly plain, the back somewhat darker than below, the inner rays of the pectoral and ventral fins dusky; fins otherwise plain, light.

Head 5; depth, at dorsal spine 5; greatest depth $4\frac{3}{5}$; D. I, 6; A. 46; V. 13-14.

We have named this species for Mr. Morton W. Fordice, a student of American fishes.

151. *Auchenipterus brachyurus* (Cope.)

XXXIII. EPAPTERUS Cope.

152. *Epapterus dispilurus* Cope.

Euanemus longipinnis Steindachner.

Locality: Hyavary, types of *longipinnis*.

XXXIV. FELICHTHYS Swainson.

Pseudauchenipterus Bleeker.

153. *Felichthys jequitinhonhae* (Steindachner.)

Locality: Jequitinhonha.

154. *Felichthys flavescens* sp. nov.

Type, No. 7362, one specimen, ♀, .10 m. Rio San Francisco. Hartt.

Elongate compressed, tapering rapidly to a slender caudal peduncle; depth everywhere much greater than the width. Head short and deep, its greatest depth little more than its greatest width, which is $1\frac{1}{2}$ in the length of the head; width at the rictus 2; head covered with loose skin, the surface of the bones not evident; frontal bones not swollen nor honey-

comb-like; frontal fontanel open in front, extending backward to about the center of the eye. Occipital process 3 times as broad as long. Dorsal plate very widely forked in front, its width at the narrowest place more than twice its length on a median line; the posterior portion of the head strongly convex in a transverse section. Four pores on the snout, no conspicuous pores on sides or top of head.

Eye longer than snout, $3\frac{1}{2}$ in the head, $1\frac{3}{4}$ in the interocular.

Maxillary barbel reaching to near tip of pectoral; mental barbel to base of pectoral, post-mental a little beyond its base.

Snout rounded, upper jaw longer; teeth all villiform, arranged as in *jequitinhonhae*.

Gill-opening extending to base of pectoral. Humeral process covered with thin skin, somewhat roughened on its surface, extending a little beyond middle of pectoral. Pectoral pore large. Lateral line undulating.

Distance of dorsal spine from snout $3\frac{1}{2}$ in the length; dorsal spine $1\frac{1}{2}$ in the head, its outer margin scarcely roughened, its inner margin slightly serrate; first soft ray $1\frac{2}{5}$ in the head. Distance between dorsal and adipose fins $2\frac{1}{2}$ in the length.

Caudal deeply forked, the lobes pointed, $3\frac{3}{5}$ in the length.

Anal emarginate, the first rays (female) not reaching to base of the last rays.

Ventrals not reaching the anal, $1\frac{3}{4}$ in the head.

Pectoral spine slightly shorter than the head, its outer edge and sides smooth, its inner margin strongly serrate.

Back brown, the color composed of numerous brown dots; top of head and snout blotched with brown on a yellow ground; opercle and a triangular spot behind the eye yellow; humeral region covered with numerous conspicuous brown dots; sides and ventral surface yellow; upper caudal lobe dusky, otherwise fins plain yellow,

Head $4\frac{1}{3}$; depth $5\frac{1}{4}$; D. I, 6; A. 20; V. 8; P. I, 6-7.

155. *Felichthys affinis* (Steindachner.)

Localities: Sao Matheos; Para.

156. *Felichthys nodosus* (Bloch.)*Auchenipterus furcatus* Cuv. & Val.

Localities: Para; Bahia.

XXXV. AUCHENIPTERICHTHYS Bleeker.**157. *Auchenipterichthys thoracatus* (Kner.)**

Localities: Coary; Hyavary.

158. *Auchenipterichthys longimanus* (Günther.)

Localities: Manes, Rio Madeira; Cameta.

XXXVI. TRACHYCORYSTES Bleeker.**159. *Trachycorystes glaber* (Steindachner.)****160. *Trachycorystes isacanthus* (Cope.)****161. *Trachycorystes insignis* (Steindachner.)****162. *Trachycorystes obscurus* (Günther.)****163. *Trachycorystes magdalenæ* (Steindachner.)****164. *Trachycorystes trachycorystes* (Cuv. & Val.)***Trachycorystes typus* Bleeker.**165. *Trachycorystes ceratophysus* (Kner.)****166. *Trachycorystes porosus* sp. nov.**

Types, No. 7351, two specimens; length .13-.15 m. Brazil.

Short and robust, little compressed; width of the head about equal to its length, its depth $1\frac{1}{4}$ in its length. Bones of the head coarsely granular. Fontanel oval. Snout and sides of the head with conspicuous pores. Three grooves on the occipital bone form a π -shaped figure, and are studied with pores; other pores on top of the head.

Eye circular, 2 in the snout, 7 in the head, $4\frac{1}{2}$ in the interocular.

Maxillary and post-mental barbels extending a little beyond base of pectoral, mental barbels extending beyond insertion of post-mentals, measuring $1\frac{2}{3}$ in the length of the head.

Lower jaw projecting; teeth fine, the intermaxillary band about 8 times as wide as deep.

Humeral process extending obliquely upward, strongly granular, its lower margin serrate; reaching a little beyond middle of pectoral spine.

Distance of dorsal spine from snout $3-3\frac{1}{2}$ in the length; dorsal spine slender, $1\frac{2}{3}-2$ in the head, its inner margin roughened, its anterior margin with a median series of diverging spines and two series of smaller teeth: the first ray higher than the spine. Space between dorsal and adipose fins $2\frac{1}{2}$ in the length; anterior margin of the adipose fin continuous with the profile of the back.

Caudal obliquely truncate.

Anal fin strongly convex behind, higher posteriorly than anteriorly.

Pectoral spine strongly serrate, the outer teeth much longer than the inner ones, especially near the tip of the spine, the flattened sides strongly granular, the granules enlarged anteriorly, forming serræ along either side of the long spine-like marginal teeth; the length of the spine 5-6 in the length.

Lateral line somewhat undulating, with conspicuous pores.

Dark reddish brown, with longitudinal interrupted bands; belly plain, lower side of head thickly dotted with darker; dorsal and anal fins spotted; caudal fin with irregular dark cross bars; inner surface of ventral and pectoral fins more or less dusky.

Head $4-4\frac{1}{2}$; depth about $3\frac{1}{2}$; D. I, 5; A. 25; V. 6; P. I, 7.

167. *Trachycorystes striatulus* (Steindachner.)

Localities: Linhares, Rio Doce; Itabapuna; Campos; Sao Matheos; Gurupa.

168. *Trachycorystes brevibarbus* (Cope.)

169. *Trachycorystes galeatus* (Linnæus.)

Auchenipterus maculosus, immaculatus & punctatus Cuv. & Val. *Auchenipterus lacustris* Lütken.

Localities: Pernambuco; San Gonçallo; Rio San Francisco, below the Falls; Tabatinga; Teffé; Rio Puty.

170. *Trachycorystes robustus* Günther.

171. *Trachycorystes analis* sp. nov.

Type, No. 7354, one specimen; length, .21 m. Arary? Professor Agassiz.

Width of the head equal to its length; width of the mouth $1\frac{3}{4}$ in length of head; the depth at the occipital process $1\frac{1}{4}$ in the length of the head. Fontanel oval, surrounded by bone.

Mental barbels less than one-third the length of the head.

Dorsal spine $1\frac{1}{2}$ in head, its anterior margin smooth except near the tip, its posterior margin slightly serrate.

Caudal broken.

Anal rays crowded, gradually decreasing in height backward, the margin undulating.

Pectoral spine very strong, $3\frac{1}{2}$ in the length.

Dark brown; ventral surface dusky with numerous dark points; dorsal fin with dark spots most prominent near the free margin; tips of ventrals dusky, the base profusely dotted, the intermediate region almost plain yellowish; pectoral fin profusely spotted.

Head 4; depth, $4\frac{3}{4}$; D. I, 6; A. 41; V. 6; P. I, 7.

Otherwise as in *maculosus*.

XXXVII. CENTROMOCHLUS Kner.

$\frac{2}{2}$ *Centromochlus*.

172. ? *Arius oncina* Schomburgk.

173. *Centromochlus heckelii* (Filippi.)

Centromochlus megalops Kner.

Localities: Villa Bella; Obidos; Para; Tabatinga; Gurupa; Manacapuru; Lago Alexo; Hyavary.

174. *Centromochlus steindachneri* Gill.

175. *Centromochlus intermedius* Steindachner.

Localities: Tajapurú; Teffé; Jatuarana; Iça; Jutahy; Lago Alexo.

176. *Centromochlus perugiæ* (Steindachner.)
 177. *Centromochlus aulopygius* Kner.
 Locality: Cudajas.
 178. *Centromochlus albescens* Reinhardt.
 Localities: Rio Parahyba; Rio Jaueiro; Macacos.

XXXVIII. WERTHEIMERIA Steindachner.

179. *Wertheimeria maculata* Steind.

XXXIX. TRACHELYOPTERUS Cuv. & Val.

180. *Trachelyopterus coriaceus* Cuv. & Val.
 Localities: Obidos; Porto do Moz.
 180^a. *Trachelyopterus coriaceus maculosus* var. nov.
 Type, No. 7337. Porto do Moz. Senhor Vinhas.

Body light brown, with longitudinal series of rusty brown spots.

XL. TRACHELYOPTERICHTYS Bleeker.

181. *Trachelyopterichthys tæniatus* Kner
 Locality: Teffé

XLI. CETOPSIS Agassiz.

 $\frac{1}{2}$ *Hemicetopsis*.

182. *Cetopsis candiru* (Spix.)
 Localities: Tabatinga; Jutahy; Tenantins; Iça.
 183. *Cetopsis plumbeus* Steindachner.

 $\frac{1}{2}$ *Cetopsis*.

184. *Cetopsis cæcutiens* (Lichtenstein.)
 Locality: Gurupa.

 $\frac{1}{2}$ *Pseudocetopsis*.

185. *Cetopsis gobioides* Kner.

 $\frac{1}{2}$ SUBGEN. NOV. ?

186. *Cetopsis occidentalis* Steindachner.
 187. *Cetopsis ventralis* Gill.

XLII. ASTEROPHYSUS Kner.

- 188.
- Asterophysus batrachus*
- Kner.

XLIII. HEMIDORAS Bleeker.

Doras Bleeker (1863, not of 1858.)‡ *Hemidoras*.

- 189.
- Hemidoras nattereri*
- (Steindachner.)

Localities: Jutahy; Coary; Teffé.

- 190.
- Hemidoras brevis*
- (Kner.)

- 191.
- Hemidoras fimbriatus*
- (Kner.)

- 192.
- Hemidoras punctatus*
- (Kner.)

- 193.
- Hemidoras lipophthalmus*
- (Kner.)

- 194.
- Hemidoras accipenserinus*
- (Günther.)

- 195.
- Hemidoras stenopeltis*
- (Kner.)

Localities: Manaos; Rio Negro; Hyavary; Manacapuru; Teffé; Obidos; Tabatinga.

- 196.
- Hemidoras stübeli*
- (Steindachner.)

- 197.
- Hemidoras morei*
- (Steindachner.)

- 198.
- Hemidoras humeralis*
- (Kner.)

- 199.
- Hemidoras carinatus*
- (Linnæus.)

Doras oxyrhynchus Val.‡ *Hassar** SUBGEN. NOV.

Shields on the anterior half of the body rudimentary or none; snout long, conical.

- 200.
- Hemidoras orestes*
- (Steindachner.)

Locality: Huytahy.

- 201.
- Hemidoras affinis*
- (Steindachner.)

Locality: Rio Puty.

XLIV. OXYDORAS Kner.

Pseudodoras & *Rhinodoras* Bleeker.

* The Arowack name for the species of *Doras*.

§ *Oxydoras*.

202. *Oxydoras niger* (Valenciennes.)

Doras humboldti Agassiz; *Corydoras edentatus* Spix; *Rhinodoras prionomus* Cope. *Rhinodoras teffeanus* Steindachner.

Localities: Tefé (types of *teffeanus*?); Gurupa; Mancapuru; Coary; Obidos.

203. *Oxydoras knerii* Bleeker.

§ *Rhinodoras*.

204. *Oxydoras d'orbigny* Kröyer.

205. *Oxydoras Amazonum* (Steindachner.)

XLV. DORAS Lacépède.

Centrochir Agassiz; *Lithodoras*, *Pterodoras*, *Platyodoras*, *Acanthodoras*, *Astroodoras* & *Amblyodoras* Bleeker; *Zathorax* & *Agamyxis* Cope.

§ *Lithodoras*.

206. *Doras dorsalis* Cuv. Val.

Doras papilionatus Filippi; *Doras lithogaster* Heckel.

Locality: Para.

§ *Doras*.

207. *Doras uranoscopus* sp. nov.

Type, No. 7235, one specimen .54 m. Lake Hyanuany. Navez.

Body rather heavy, depressed, depth below the dorsal spine $\frac{3}{4}$ as great as the width; caudal peduncle rather slender, wider than high. Width of the head $1\frac{1}{2}$ in its length; top of the head to near tip of snout, opercle, preopercle, suborbital and pre-nasal bones striate, the striæ becoming broken up into granules in places, which, on the dorsal plate are spine-like, similar to those on the lateral scutes. Dorsal plate not continued behind the anterior margin of the dorsal spine, with a downward directed process. Interorbital area flattish; posterior portion of the head obtusely keeled. Fontanel club-shaped, not extending to the posterior margin of the eye; an elongate diamond-shaped depressed area behind it.

Eye $3\frac{1}{2}$ –4 in the snout, $8\frac{1}{2}$ in the head, 3 in the inter-orbital; eye more superior than lateral.

Maxillary barbels extending to posterior 4th of humeral process; post-mentals to opposite the insertion of the inner pectoral ray; mentals about $\frac{2}{3}$ as long as the post-mentals.

Snout pointed, its width at the rictus $2\frac{1}{2}$ in the head. Upper jaw projecting; teeth villiform, the intermaxillary band about six times as wide as deep.

Gill opening extending to a point midway between upper angle of preopercle and the eye.

Lateral scutes high, the third hook-bearing one the highest, $1\frac{3}{4}$ in the length of the head, the scutes decreasing in height to the last, the median hooks increasing in size to the caudal peduncle, the exposed surface of those in front of the peduncle thickly set with small spines. Accessory rays of the caudal fin ossified, the anterior one forming a small plate. Exposed part of the skin verrucose.

Humeral process narrow, tapering backward, reaching a little beyond the middle of the pectoral spine.

Distance of the dorsal fin from the snout about $2\frac{2}{5}$ in the length. Dorsal and pectoral spines with the sides deeply furrowed, both margins serrate; the serration of the posterior margin of the dorsal spine reduced to a few spines. Adipose fin low, merging into the profile of the back anteriorly.

Caudal emarginate, 5 in the length.

Anal high, rounded, first ray highest, 2 in the head.

Ventral as high as the anal fin.

Pectoral spine not quite reaching the ventral fins. Pectoral pore minute.

Fins spotted with brown.

Head 4; depth 5; Lat. 1. 18; D. I, 6; A. (injured?) 6; V. 6; P. I, 9.

208. *Doras maculatus* Valenciennes.

? *Doras granulosus* Val. *Doras murica* Natterer.

Locality: Avary?

209. *Doras longipinnis* Steindachner.
? *Doras crocodili* Humboldt.
210. *Doras albomaculatus* Peters.
211. *Doras helicophilus* Günther.
212. *Doras dentatus* Kner.
213. *Doras costatus* (Linnaeus).
Localities: Rio Puty; Rio Preto; San Gonçallo; Xingu Cascade; Obidos;
Gurupa; Teffé.
214. *Doras armatulus* Cuv. & Val.
215. *Doras hancockii* Cuv. & Val.
216. *Doras brachiatus* Cope.

§ *Acanthodoras*.

217. *Doras calderonensis* Vaillant.
Doras depressus Steindachner.
218. *Doras cataphractus* (Linnaeus.)
Cataphractus americanus Bloch & Schneider; *Doras blochii* Cuv. &
Val.; ?*Doras brunnescens* Schomburgk; *Doras polygramma* & *poly-*
gramma Heckel; *Callichthys asper* Gronow.
219. *Doras spinosissimus* sp. nov.
Type, No. 7222, one specimen .15 m. Coary. Professor L. Agassiz.

Short and thick, the width below the dorsal spine greater than the depth; caudal peduncle little deeper than wide. Head as broad as long, its depth $1\frac{1}{3}$ in its length: top of head, opercle, preopercle and suborbitals finely granular; the nasal bones with their free margin spinous. Top of head broad and flattish. Dorsal plate broad, without prominent downward or backward processes. Sutures of the skull marked by smooth lines. Fontanel reduced to a small oval opening surrounded by granulations.

Eye $1\frac{1}{4}$ in the snout, 7 in the head, 3 in the interorbital.

Maxillary and post-mental barbels reaching to the pectoral pore; mental barbels $\frac{2}{3}$ as long as the post-mentals.

Snout broad, its width at the rictus $1\frac{1}{3}$ in the head. Jaws subequal; teeth minutely villiform, the intermaxillary band six times as wide as deep.

Gill-opening continued forward to below the upper angle of the preopercle. Humeral process not reaching the tip of the pectoral spine by about an orbital diameter, its surface with short sharp spines, a series of which near the lower margin, is enlarged. Lateral scutes very high, covering almost the entire sides, those above the first anal ray highest, $1\frac{2}{3}$ in the head, those on the caudal peduncle meeting the scutes of the other side above and below; each lateral scute posterior to the dorsal plate has a median hook and 5-14 smaller spines above and below it.

Basal half of the caudal rays with about five series of small spines.

Distance of the dorsal fin from the snout $2\frac{1}{4}$ in the length; dorsal spine $1\frac{2}{3}$ in the length of the head; its posterior margin smooth, its sides and anterior margin with many short spines, a smooth groove between the spines of the sides and front margin. Distance between dorsal and adipose fins $3\frac{1}{2}$ in the length; adipose fin oval, as long as the dorsal fin without the spine.

Caudal rounded, two in the head.

Anal rounded, the central rays the highest, as high as the length of the caudal.

Ventrals not reaching the anal, 2 in the head.

Pectoral spine strong, not reaching the ventral fins; its lower surface bluntly granular, its upper with short teeth like those on the humeral process, both margins finely serrate.

Brown, marked with white; a white lateral band not as wide as the eye; a median series of white spots on the back; ventral surface and sides of the head irregularly spotted with white; top of the head with a median, interrupted light band; dorsal, pectoral and ventral fins spotted and marbled with brown and white; posterior margin of the adipose white; caudal and anal fins with undulating cross-bars of white and brown. Barbels annulated with brown and white.

Head $3\frac{4}{5}$; depth 5; Lat. l. 26; D. I, 5; A. 12; V. 6; P. I, 6.

220. **Doras marmoratus** Reinhardt.

Localities: Rio San Francisco; Rio das Velhas.

‡ *Amblydoras*.

221. **Doras affinis** Kner.

Doras truncatus Bleeker.

222. **Doras weddellii** Castelnau.

Doras grypus Cope.

Localities: Fonteboa; Teffé; Serpa; Porto do Moz; Silva, Lake Saraca.

§ *Centrochir*.

223. **Doras crocodili** Humboldt.

§ *Agamyxis*.

224. **Doras castaneo-ventris** Schomburgk.

225. **Doras pectinifrons** Cope.

§ *Astrodoras*.

226. **Doras asterifrons** Heckel.

Localities: Jutahy; Teffé; Porto do Moz; Serpa.

227. **Doras heckelii** Kner.

Localities: Jutahy; Tonantins; Teffé; Tabatinga.

228. **Doras monitor** Cope.

229. **Doras nauticus** Cope.

XLVI. **PHYSOPYXIS** Cope.

230. **Physopyxis lyra** Cope.

ARGIIDÆ.

I. **ARGES** Cuv. & Val.

Brontes Cuv. & Val.

1. **Arges sabalo** Cuv. & Val.

2. **Arges prenadilla** Cuv. & Val.

A. brachycephalus Günther.

3. *Arges longifilis* Steindachner.

4. *Arges peruanus* Steindachner.

II. ASTROBLEPUS Humboldt.

5. *Astroblepus grixalvii* Humboldt.

III. CYCLOPIUM Swainson.

Stygogenes Günther.

6. *Cyclopium cyclopum* (Humboldt.)

Cyclopium humboldti Swainson; *Stygogenes humboldti* Günther.

Locality: Quito.

7. *Cyclopium güntneri* Boulenger.

CALLICHTHYIDÆ.

I. SCLEROMYSTAX Günther.

1. *Scleromystax barbatus* (Quoy & Gaimard)

II. CATAPHRACTUS Bloch.

Callichthys Cuv. & Val.

2. *Cataphractus callichthys* (Linnæus.)

Callichthys tamoata Linnæus; *Callichthys asper* Quoy & Gaimard; *Callichthys cælatus* & *leviceps* Cuv. & Val.; *Callichthys loricatus* Gronow; *Callichthys kneri* Gill; *Callichthys affinis* Günther; *Callichthys hemiphractus* Hensel.

Localities: Rio de Janeiro; Pernambuco; Juiz de Fora; Bahia; Mendez; Macacos; Porto Seguro; Surinam.

3. *Cataphractus arcifer* Hensel.

III. HOPILOSTERNUM Gill.

4. *Hoplosternum littorale* Hancock.

Callichthys subulatus & *albidus* Cuv. & Val.; *Callichthys levigatus* Val.

Hoplosternum stevardii Gill.

Localities: Surinam; Gurupa; Para; Santarem; Tabatinga; Avaray; Silva, Lake Saraca; Villa Bella; Porto do Moz; Lake Hyanuay; Ueranduba.

5. *Hoplosternum thoracatus* (Cuv. & Val.)

Callichthys longifilis Cuv. & Val.; *personatus* Ranzani; *exaratus* & *pictus* Müll. & Trosch.; *subcatus* Kner; *chiquitos* Castelnau.

Localities: Curupira; Tabatinga; Cudajas; Gurupa; Teffé; Lake Hyanuary; Villa Bella; Para; Uerunduba; Santarem; Porto do Moz; Pernambuco; Obidos.

6. *Hoplosternum melampterus* (Cope.)

IV. DECAPOGON gen. nov.

Lower lip with a series of six barbels; ventral surface entirely mailed.

7. *Decapogon adpersus* Steindachner.

Localities: Cudajas; Tabatinga; Porto do Moz.

V. DIANEMA Cope.

8. *Dianema longibarbis* Cope.

VI. BROCHIS Cope.

Chænothorax Cope.

‡ ? nov.

9. *Brochis taiosh* (Castelnau.)

‡ *Chænothorax*.

10. *Brochis bicarinatus* (Cope.)

11. *Brochis semiscutatus* (Cope.)

§ *Brochis*.

12. *Brochis dipterus* Cope.

13. *Brochis cœruleus* Cope.

VII. CORYDORAS Lacépède.

Hoplisoma Swainson; *Hoplosoma* Gill; *Gasterodermus* Cope.

14. *Corydoras eques* Steindachner.

Locality: Cudajas.

15. *Corydoras splendens* (Castelnau.)

16. *Corydoras elegans* Steindachner.

Locality: Cudajas.

17. *Corydoras nattereri* Steindachner

Localities: Rio Doce; Rio Parahyba.

18. *Corydoras æneus* (Gill.)
19. *Corydoras armatus* (Günther.)
20. *Corydoras paleatus* (Jenyns.)
Corydoras marmoratus Steindachner; *Callichthys punctatus* Val. and
Cuv. & Val.
Locality: Uruguay.
21. *Corydoras punctatus* (Bloch.)
Corydoras geoffroy Lacépède; *Corydoras ambiacus* Cope.
Locality: José Fernandez.
22. *Corydoras trilineatus* Cope.
Corydoras agassizii Steindachner.
23. *Corydoras acutus* Cope.
24. *Corydoras amphibelus* Cope.
25. *Corydoras hastatus* sp. nov.

Types, No. 7747, two specimens .022 m. Villa Bella. Prof. L. Agassiz.

Compressed, comparatively slender. Head as deep as long, its width $1\frac{1}{3}$ in its length; profile straight, steep: occipital process triangular; fontanel elongate, extending into the occipital bone; preorbital small.

Eye large, $1\frac{1}{2}$ in the snout, $3\frac{1}{2}$ in the head, 2 in the inter-orbital. Snout little decurved; rictal barbels not extending beyond the eye; lower lip terminating in two barbels.

Coracoid processes striate, forming a ridge on the sides of the belly.

Distance of the dorsal spine from the snout two in the length; the dorsal spine little shorter than the head.

Caudal deeply forked, $2\frac{3}{4}$ in the length.

Pectoral spine little longer than the dorsal spine, weakly serrate along both margins.

Light brown; a jet black lateral band terminating at the base of the caudal in a large arrow-shaped spot, which is bordered posteriorly with white, itself narrowly margined with blackish, the caudal dusky beyond; a jet black line extends on either side from a short distance

behind the ventrals to behind the anal fin; body and fins everywhere covered with minute black points.

Head $3\frac{1}{3}$; depth $2\frac{3}{4}$; D. I, 7-8; A. 7-8; Lat. l. $\frac{2}{5}\frac{2}{0}$.

LORICARIIDÆ.

I. PLECOSTOMUS* Gronowius.

Hypostomus Lacépède; *Cochliodon* Heckel.

‡ *Cochliodon*.

1. **Plecostomus cochliodon** (Kner.)

Cochliodon hypostomus Heckel MS.

§ *Plecostomus*.

2. **Plecostomus spinosissimus** Steindachner.

3. **Plecostomus emarginatus** Cuv. & Val.

H. horridus Kner; *Pl. scapularius* Cope; *Pl. tenuicauda* Steindachner.

Localities: Cudajas; Santarem; Manacapuru; Tonantins; Obidos; Fonteboa; Tabatinga; Hyavary; Sao Paulo; Goyaz.

4. **Plecostomus limosus** sp. nov.

Types, No. 7869. Four specimens .25 m. Rio Grande do Sul, from the Emperor's collection.

*The species of this genus are all closely allied, and the new species can best be described by the following key, which represents the relationships, as near as we can trace them:

a. D. I, 7.

b. A. 5.

c. Jaws with 7 or 8 broad tipped teeth (*Cochliodon*). *cochliodon* 1

cc. Jaws with numerous fine teeth (*Plecostomus*).

d. Head with three distinct ridges, snout pointed, head usually elevated, occipital bone ending in a pointed occipital process.

e. Ventral surface covered with small plates.

f. Free margins of the lateral plates with long spines.

spinosissimus 2

ff. Free margins of the lateral plates with short spines or none.

g. Post-humeral ridge becoming strongest on the tail, which is flat below. *emarginatus* 3

gg. Post-humeral ridge strongest in front, lower surface of tail similar to the upper surface.

5. *Plecostomus carinatus* Steindachner.6. *Plecostomus commersonii* (Valenciennes.)

H. punctatus Cuv. & Val.; *H. subcarinatus* Castelnau; *Pl. spiniger* Hensel.

Localities: Rio de Janeiro; Santa Cruz; Macacos; Itabapuaana.

6a. *Plecostomus commersonii affinis* Steindachner.

Localities: Mendez; Santa Clara; Rio Mucuri; Rio de Janeiro; Rio Doce at Linhares; Rio Parahyba; Minas Geraes; San Antonio River.

6b. *Plecostomus commersonii scabriceps* var. nov.

Types, No. 7894. Three specimens. 30-35 m. Sao Matheos. Hartt & Copeland.

h. Tip of snout naked; lat. 1. 28-30; occipital bone margined by a single large nuchal plate

i. Spots on the caudal less distinct than those on the dorsal; all the scutes with high keels.

j. Lat. 1. 28. Eye $4\frac{1}{2}$ in snout, 8 in head, 3 in interorbital; outer caudal rays little produced, middle caudal rays $1\frac{1}{2}$ - $1\frac{1}{4}$ in the head. Base of the dorsal fin equal to its distance from the caudal, or very little shorter. *limosus* nov. 4.

jj. Lat. 1. 30. Eye $3\frac{1}{2}$ in snout; 6- $6\frac{1}{2}$ in head.

carinatus 5.

ii. Spots on the caudal as distinct as those on the dorsal.

k. Lower surface of the head covered with scutes.

l. Spots all small, 12 or more on one of the anterior scutes. *commersonii* 6.

ll. Spots large, not more than 4 on one of the anterior scutes. *commersonii affinis* 6a.

kk. Lower surface of the head naked, except a triangular spot in front of the gill opening; spots as in *affinis*; occipital process short.

commersonii scabriceps nov. 6b.

hh. Tip of snout granular, occasionally naked in *plecostomus*.

m. Lateral plates all more or less strongly keeled. *plecostomus* 7.

mm. Lateral plates, scarcely, if at all, keeled. Lat. 1. 27-28.

n. Head with vermiculating light and dark lines; ventral surface with short curved bars. *vaillanti* 8.

7. *Plecostomus plecostomus* (Linnæus.)

H. guacuri Lacépède; *L. flava* Shaw; *H. veres* Cuv. & Val.; *Pl. bicirrhosus* Gronow.; *Pl. brasiliensis* Bl.

Localities: Silva, Lake Saraca; Para; Hyavary; Coary; Rio Puty.

8. *Plecostomus vaillanti* Steindachner.

Localities: Rio Puty; Rio Preto; San Gonçallo.

9. *Plecostomus villarsi* Lütken.10. *Plecostomus virescens* Cope.11. *Plecostomus biseriatus* Cope.12. *Plecostomus seminudus* nov.

Type: A single specimen. Locality: Brazil?

13. *Plecostomus annæ* Steindachner.14. *Plecostomus pantherinus* (Knér.)

nn. Head with round spots; ventral surface plain. *villarsi* 9.

ll. Ventral surface more or less naked.

o. Lower surface of head naked.

virescens 10.

oo. A quadrate naked space between the ventrals. *biseriatus* 11.

ooo. Belly with scutes on the sides, and sometimes a narrow strip between ventrals.

p. Lat. 1. 27. Upper lateral plates with strong median keel; head with strong occipital and weaker temporal keels; nuchal plates bicarinate. A band between the pectorals, sides of the belly and a narrow median area between the ventrals covered with scutes. Dorsal surface, sides and fins spotted with brown; ventral surface plain.

seminudus nov. 12.

pp. Lat. 1. 30; lateral plates not keeled.

annæ 13.

oooo. Belly entirely naked. *pantherinus* 14.

dd. Head without distinct ridges or keels; snout broad, rounded.

q. Belly covered with granular plates.

r. Tip of snout naked.

s. Dorsal crossed by six or seven black zig-zag stripes.

cordovæ 15.

15. *Plecostomus cordovæ* Günther.
 16. *Plecostomus lima* Reinhardt MS.
 17. *Plecostomus macrops* sp. nov.
 Type No. 7888. One specimen, .28 m. Rio das Velhas. Allen & St John.
 18. *Plecostomus francisci* Lütken.
 19. *Plecostomus alatus* (Castelnau.)

ss. Dorsal spotted or uniform dusky.

t. Superciliary edge not raised, interorbital convex; eye $3\frac{1}{2}$ in snout, $6\frac{1}{2}$ in head, 2 in interorbital; post-temporal with a long descending process which forms the entire posterior margin of the orbit. *lima* 16.

tt. Superciliary edge greatly raised, interorbital area concave; eye 3 in the snout, $5\frac{1}{3}$ in the head, $1\frac{3}{4}$ in the interorbital; post-frontals without a descending process; dorsal uniform dusky. *macrops* nov. 17.

rr. Tip of snout granular; eye $6\frac{1}{2}$ in head. *francisci* 18.

qq. Belly partially or wholly naked.

u. Each of the larger lateral plates with two or three yellow spots; eye 2 in the interorbital. *alatus* 19.

uu. Sides of the body and the fins with longish yellowish spots; head as wide as long. *aurogutattus* 20.

uuu. Sides of the body usually with round dusky spots; fins similarly spotted or plain.

v. Occipital bone bordered by two or three nuchal plates.

w. Caudal plain. *lütkeni* 21.

ww. Caudal with wavy cross bars formed by dusky spots. *vermicularis* nov. 22.

www. Caudal with two series of spots between each two rays. *brevicauda* 23.

vv. Occipital bordered by a single nuchal plate.

x. A single series of large round spots between two dorsal rays. *robinii* 24.

xx. Two series of spots between two dorsal rays; upper caudal lobe little shorter than the lower. *wuchereri* 25.

xxx. Spots on the caudal much smaller than those on the dorsal; caudal very obliquely truncate. *johnii* 26.

bb. A. 6-8. (*Neoplecostomus*)

y. A. 6

microps 27.

yy. A. 8

granosus 28.

20. *Plecostomus auroguttatus* (Kner.)
H. asperatus Castelnau.
21. *Plecostomus lütkenii* Steindachner.
 Localities: San Antonio River; Campos.
22. *Plecostomus vermicularis* sp. nov.
 Types, Nos. 7814; 7848; 7849; 7850; 7851; 7857. Thirty-seven specimens. .08—.30m. Rio Parahyba; Rio Janeiro; Mendez; Macacos; Goyaz.

This species is closely related to *Pl. lütkeni* Steind.

The ventral surface in the adult is almost entirely covered with granules, except a large naked area at base of ventrals; the anus is surrounded with granules. In the young, the belly is almost wholly naked, there being only a few granules in front of the anus, on the sides of the belly and on the throat.

The spots on the head frequently coalesce into vermiculations; all the fins are profusely spotted with dark, the spots on the dorsal, pectoral and ventral fins sometimes coalescing into cross bars, those on the caudal forming regular transverse series. Upper surface of the body with obscure markings, ventral surface plain.

Eye 3-4 in the snout, $5\frac{1}{2}$ -8 in the head, $2-2\frac{3}{4}$ in the inter-orbital. Lat. l. 26-27. Head $3-3\frac{2}{7}$.

23. *Plecostomus brevicauda* Günther
24. *Plecostomus robinii* Cuv. & Val.
Pl. una Steindachner.
 Locality: Rio Una.
25. *Plecostomus wuchereri* Günther.
 Locality: Rio Pedra.
26. *Plecostomus johnii* Steindachner.
 Localities: Rio Preto; Rio Puty.

NEOPLECOSTOMUS SUBGEN. NOV.

Type *Plecostomus microps* Steindachner.

27. *Plecostomus microps* Steindachner.
 Localities: Juiz de Fora, Rio Parahyba; Goyaz.
28. *Plecostomus granosus* (Cuv. & Val.)
 ? *Plecostomus watwata* Hancock.

REMARK.—Since writing the above, we have studied the *Siluridae Opisthopterae* of Günther (= *Trichomictoridae*). The genus *Heptapterus* cannot be retained in the *Trichomictoridae*. It is very closely related to *Rhamdella*, which should be raised to generic rank. In *Heptapterus* the modified anterior vertebræ have simple lateral processes beneath which the air-bladder lies free in the abdominal cavity, as in the *Siluridae* proper. In *Trichomictoridae* the anterior vertebræ are coalesced, but the lateral processes are greatly complicated, forming a closed capsule in which is concealed the pair of small round air-bladders. Leaving out of consideration the position of the dorsal in its relation to the ventral fins, *Heptapterus* and also the genus *Nannoglanis* Boulenger possess all the characters which define the group *Pimelodine* Günther. That the relative position of the dorsal and ventral fins is of no great importance may be gathered from a comparison of the following plates: Lütken, Rio das Velhas Flodens Fiske, pl. III, figs. 6–7; Steindachner, Flussf. Südam. III, pl. V, fig. 1, and Boulenger, Proc. Zool. Soc., 1887, pl. XXI, fig. 3, representing the genera *Pimelodella*, *Heptapterus* and *Nannoglanis*. After *Rhamdella* should therefore be inserted

VIa. HEPTAPTERUS Bleeker.

36a. *Heptapterus mustelinus* Valenciennes.

Locality: Maldonado.

36b. *Heptapterus surinamensis* Bleeker.

36c. *Heptapterus collettii* Steindachner.

VIb. NANNOGLANIS Boulenger.

36d. *Nannoglanis fasciatus* Boulenger.

NOTES ON THE GEOLOGY OF BAJA CALIFORNIA, MEXICO.

BY W. LINDGREN, U. S. GEOL. SURVEY.

[The notes here presented are based on observations taken during a few weeks' visit in January, 1888, to the vicinity of Todos Santos Bay and the mountains east of it. They are necessarily somewhat fragmentary, especially as inclement rainy weather and snow in the mountains greatly interfered with the work. This paper will shortly be followed by another devoted to the micropetrography of the region here described.]

But little is at present known of the geology of the Californian Peninsula or Baja California. Almost the only trustworthy source is Prof. Gabb's description, published in the Appendix to Whitney's "Geology of California," Vol. I. This paper is founded on observations during a trip through the entire peninsula from La Paz to San Diego, undertaken in 1867, with Mr. J. Ross Browne, Sr., in order to examine certain land grants in the central part of the territory.

Some notes relating to the peninsula are found in the reports of the Mexican Boundary Survey and in Prof. Blake's geological notes accompanying the Pacific Railroad Reports. The only paper relating to the palaeontology of the territory is Dr. C. A. White's "On New Cretaceous Fossils from California," Bull. No. 22, U. S. Geol. Survey publications.

GENERAL TOPOGRAPHY.

The peninsula of Lower or Baja California is nearly 700 miles long, and on an average 60 miles wide; it extends from lat. 23° to $32^{\circ} 30'$. Generally speaking, it is occupied by a "one-sided" mountain range, sloping gradually and gently towards the Pacific, abruptly towards the Gulf of California, or, in the north, to the low deserts adjoining the gulf. Following Prof. Gabb, we may, topographically, divide the territory into three parts:

1. The extreme south, from La Paz to Cape St. Lucas. This small division apparently differs in structure from the rest, and is said to be occupied by a transverse E. - W. chain, not exceeding 5,000 feet in elevation.

2. In the 300 miles of distance from La Paz to Santa Gertrudis the divide of the peninsula is placed very near the eastern coast, and its elevation does not exceed 4,000 feet; frequently it is not more than 3,000 feet. The eastern slope is abrupt and steep, while the western is occupied by gently inclined and smooth table-lands or mesas, separated by narrow, rocky cañons.

3. The northern division, from Santa Gertrudis to the boundary line, is more varied in its topographic features. The table-lands disappear, and a mountain chain rising in the middle of the peninsula fills with its branches the whole western half; the eastern chain becomes lower and soon sinks under the sands of the desert plains adjoining the gulf.

Rising rapidly, the western chain reaches an elevation of 10,000 to 11,000 feet in the range of San Pedro de Martis, about 120 miles south of the boundary line. From here it sinks again, and runs with a maximum elevation of from 5,000 to 6,000 feet up to Alta California. In the section referred to and described in these notes, from Todos Santos Bay eastward to the mouth of the Colorado River, a distance of about 100 miles, the summit of the range runs at a distance of 60 miles from the Pacific, and divides the peninsula into two distinct parts—the Desert and the Peninsular Cordillera. This division applies for a distance of at least 100 miles south of the boundary line.

The topographic features of the long western slope of the Cordillera are somewhat diversified, but on the whole they may be divided into three sections:

1. The coast range, or the first orographic block, rising gradually from the sea to an elevation of 3,000 feet in a dis-

tance of 20 to 30 miles. Surmounting this are several minor ranges and sharp peaks attaining an elevation of 3,000 to 4,000 feet. Consulting Plate II, it will be seen that on the whole these latter form an interrupted series running from the boundary to below Santo Tomas at a distance of 10 to 15 miles from the coast. A rapid descent leads from the divide of the coast range to—

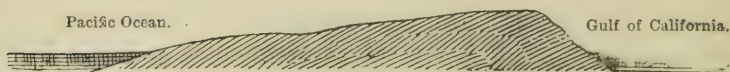
2. The interior valleys, an interrupted series of depressions in the middle of the chain at an elevation of from 1,800 to 2,000 feet.

3. The second orographic block, rising rapidly from the valleys and continuing as an almost level plateau with a gentle slope up to the peninsular divide, and the abrupt, almost precipitous descent to the desert. The elevation of this remarkable plateau is from 4,000 to 5,000 feet.

The desert forms a sandy plain, traversed by a few lower ranges, running northwesterly and southeasterly, and has in general a very inconsiderable elevation. Part of this plain is doubtless depressed below the level of the sea.

GENERAL GEOLOGY.

According to Prof. Gabb, the characteristics of the three principal divisions of the peninsula are as follows: The extreme south is occupied by a granitic range with mica-schists exposed on the northern side. The second division is pre-eminently that of the *mesa sandstones*. For a distance of over 300 miles the largest part of the peninsula is formed by these. Heavy beds of generally non-fossiliferous, coarse sandstones slope with a gentle dip westward from the divide towards the Pacific. Towards the east the strata, during the rapid descent to the Gulf, as a rule, preserve the same dip. It appears as if the sandstones had been cut off by a gigantic fault. A section across the peninsula would be somewhat as shown in Fig. 1.



The age of these sandstones has not been determined by Prof. Gabb. He suggests that they *may* belong to the Miocene period from the fact that certain fossil *Ostraea*, indicative of that period, were once sent to the U. S. National Museum from the southern part of the peninsula. The sandstones often contain large pebbles of volcanic rocks, suggesting their being deposited near the shore line of some continent, possibly once situated where now the gulf extends. In some parts of the division extensive metamorphism prevails, but the exact character of the resulting metamorphics is not clearly indicated; the metamorphic action seems to be confined to a belt near the summit and along the eastern shore, and rather appears to be a regional metamorphism than one connected with granite or eruptive rocks. In many places recent dikes and lava flows cut and cover the sandstones. An especially remarkable recent volcanic belt crosses the peninsula from San Ignacio to the volcano of Las Tres Virgines. Post-pliocene deposits of small depth cover the mesa sandstone to an elevation of 400 to 500 feet.

Some distance north of Santa Gertrudis the mesa sandstones cease to form the major part of the peninsula, but continue to skirt the shore for a long distance. The western mountain chain, which now becomes dominant, appears to be mainly composed of granitic rocks, covered in places by recent or older eruptive rocks. This granitic chain continues northward till it crosses the boundary line and joins the San Jacinto Mountains in San Diego County. Prof. Gabb's notes from the northern section are not so complete as those from the southern and central part, and of the region to be described here he has but few words to say. It would be highly desirable to obtain a geological section of

the peninsula across the range of San Pedro de Martis, or about 150 miles south of the boundary line.

The geology of the surroundings of San Diego and the section from there to the Colorado River is known principally from the notes of Prof. Blake while attached to the Pacific Railroad Surveys. A copy of this profile will be found in Plate II, fig. 2. The coast at San Diego is covered by deep post-pliocene strata (sand, clay, etc.), and these deposits extend for about twenty-five miles inland, forming a very gently sloping mesa, at the eastern edge of which granitic rocks make their appearance; in some places there seems to be a narrow belt of porphyritic eruptives at the western edge of the granite.* The now more rapid ascent leads for thirty miles exclusively over granite to the summit, from which there is an abrupt descent to the Colorado Desert, although not quite so marked as further south. The distance from the base of the mountains to the Colorado River is about eighty miles. From near the summit the whole eastern slope, according to Prof. Blake, is made up of metamorphic slates of the age of which nothing definite is known. Although the whole long western slope is indicated as granite in the reports mentioned, still it is certain that the granite area contains one, if not several, enclosed masses of metamorphic slates. So, for instance, at Julian, not very far north of the boundary line.† Recent eruptives are not mentioned, and it would appear, indeed, that they are very scarce in the western part of Southern California; off the coast there is, however, a volcanic belt with basaltic lavas along the islands.‡

Going south from San Diego, the level post-pliocene beds change into a hilly coast, the higher mountains extending close to the sea. About forty miles southward recent volcanic flows, coming down to the sea in

* See Mex. Bound. Survey, Geol. Report.

† Report of the State Mineralogist of Cal., 1886.

‡ Whitney, Geology of California, Vol. 1.

abruptly ending tables 400 to 600 feet high, form a rocky coast line, which continues down to Cape St. Miguel. (See Plate II.) Beyond the coast higher, flat-topped mountains, probably also of volcanic origin, rise. At the cape just mentioned, the great bay of Todos Santos, or All Saints, opens, forming a wide sweep and terminating southward at the rough promontory of Punta Banda. (See Plate II.) Mountains 2,000 to 3,000 feet high form a sort of amphitheater around the bay, and the foothills come down close to the shore. One may distinguish several separate chains or masses, one running E. S. E. - W. N. W., forms Punta Banda, ending westward in a sharp peak 1,200 feet high, and culminating in the 3,500 feet high mountain between the Maneadero and Santo Tomas. Another mass, extending N. - S., but cut in two by a lower pass east of Ensenada, has its culminating point in a peak about ten miles N. N. E. of Ensenada. The rivers carrying but little water and mostly sinking in the sand before reaching the sea, run in deep cañons to a few miles distance from the coast, when they debouch in large, level, alluvial valleys, containing some arable land; such are Ensenada Valley and El Maneadero. At other places, the foothills, distant a mile or two from the sea, are skirted by a band of mesa land rising gently or in terraces from the sea to an elevation of 50 feet; so, for instance, at San Carlos, between Ensenada and El Maneadero. The region adjoining Todos Santos Bay has been examined in a somewhat more detailed way, and a geological sketch map of it prepared. (See Plate IV.)

The maps of the International Colonization Company of Ensenada and surroundings, extended by my own observations, have been used as a topographic basis.

The different terranes on this special map will now be discussed separately.

DETAILED GEOLOGY.

POST-PLIOCENE STRATA.—Although these deposits do not form a prominent and conspicuous part of the topography, they may be found in several places along the shore of Todos Santos Bay. The numerous oscillations of the shore line during post-pliocene time are equally plain in Lower California as along the coast north of it. According to Prof. Gabb these strata cover the mesa sandstones for hundreds of miles to the south up to an elevation of 500 to 600 feet above the sea, and consist of loose sands with shells, calcareous marls, etc. At Todos Santos Bay the deposits are not extensive, but in places the old shore lines, indicating several pauses in the movement, may be observed. At Ensenada there are no preserved strata, but the low mesa at San Carlos belongs to this division. In the low hills skirting the Sausal Valley remains of these strata occur resting on porphyritic rocks. There are white, loose sandstones with remains of shells; further up, one mile north of Sausal, a cliff about thirty feet high shows a succession of sandstones and yellow clay with coaly vegetable remains. On such seams the report of the occurrence of coal beds between Todos Santos and San Diego appears to be founded. Better than at any other point the ancient shore lines are shown on Punta Banda, as often well marked wave-built terraces. Two such shore lines are plainly seen running along the promontory, but on closer investigation, at least four distinct ones may be found. The lowest and plainest about 40 feet above the sea; above that another, not so distinct, at 180 feet; further up, indistinct remains of beaches, at 470 and 600 feet. The accumulations along the lowest beach line consist of sands and gravel of porphyritic rocks, together with numerous fragments of shells.

TERTIARY STRATA.—These seem to be entirely absent, or have at least not yet been found along the upper coast of Lower California, an absence made more conspicuous by

the enormous development of miocene strata in Southern California. It is probable that this region from the present shore line to the desert was not submerged during tertiary times; observations tending to confirm this view will be recorded further on.*

CRETACEOUS STRATA.—The first evidence of the existence of these in Lower California was furnished by a few fossils sent to the national museum by Mr. C. R. Orcutt of San Diego, who found them at the southern shore of Todos Santos Bay.

Dr. C. A. White has mentioned and described these fossils,† arriving at the interesting conclusion that the beds in which they occur belong to a formation which has hitherto not been recognized, and which probably occupies a position between the Chico and Shasta groups.

They are equivalent with another series previously found by Dr. G. F. Becker‡ along the shores of Mendocino County, and consisting of sandstones and shales, resting unconformably on metamorphic rocks, presumably to be referred to the Shasta group. It has been proposed to call the new series the Wallala group, from a locality near the northern occurrence. The fauna described by Dr. White comprises one new genus and five new species. Specially characteristic of the formation is the new genus *Coralliochama* (Chamidæ), closely allied to the European genera of *Caprima*, *Plagioptychus* and *Ichthyosarcolithes*; further, a few small species of *Cerithium*, *Trochus* and *Nerita*. Consulting the sketch map of Todos Santos Bay (Pl. IV), it may be seen

* Miocene fossils have recently been found at Boleo, opposite Guaymas, in the southern part of the peninsula. They occur in a series of gravels, clay and marls, interstratified with andesitic volcanic material. See E. Fuchs, Sur le gîte de cuivre de Boléo. Bull. Soc. Géol. de France, XIV, 2, 79. 1886.

† Bull. 22, U. S. G. S. On new Cretaceous fossils from California. Bull. 15, U. S. G. S. On the Mesozoic and Cenozoic Palæontology of California.

‡ Bull. No. 19, U. S. Geol. Survey. Notes on the stratigraphy of California.

that the exposures are not very extensive; they are, in fact, limited to a patch about three miles long east and west, and one mile north and south, on the northern side of Punta Banda. This promontory consists mainly of old porphyritic rocks, against which the cretaceous strata have been deposited (See profile 2, Plate V); they form a perpendicular sea cliff about fifty feet high, and extending for about two and a half miles along the shore; in most places post-pliocene gravel and sand cover the top of the cliff, but cretaceous exposures may be found a little higher up, protruding from the later, covering beds.

The strata consist of a series of yellow, coarse sandstones, interstratified with heavy conglomerates of well rolled pebbles up to a foot in diameter, evidently petrographically identical with the massive rocks forming the peninsula and derived from them. The beds being very heavy, exact dips and strikes are difficult to obtain; they incline somewhat northward, dips from 10° to 20° being observed.

In these heavy sandstones, generally void of fossils, there are at intervals strata two to four feet thick composed entirely of the calcareous shells of *Coralliochama*, accompanied by a small specimen of *Cerithium*. The fauna is decidedly monotonous, and but a few new forms were found.

There are strong reasons for believing that this isolated cretaceous mass is but the first of a series of similar strata farther south, and I only regret that I could not extend my trip in that direction. On Todos Santos Island, about twelve miles from the coast, there appears to be an exposure of sandstone similar to that of Punta Banda. At the harbor of Santo Tomas, 40 miles south of Ensenada, a steep sandstone cliff, containing many and large pebbles, is said to form the coast. Similar sandstones occur at Cape Colnett, about 70 miles south of Ensenada. From here it is not very far to where the mesa sandstones begin, and it appears to me quite probable that these also will eventually be found to belong to the cretaceous period. Gabb has followed the

sandstones more carefully on the eastern than on the western coast, and states expressly, regarding the former, that they continue to skirt the coast for a long distance north of the end of the second or middle division, where they occupy the whole peninsula. His description of the appearance of the sandstone corresponds very well indeed with the Todos Santos occurrence. It must be remembered that Gabb did not determine the age of the mesa sandstones, but only conjectured, based on a very slight clew, that they were Miocene. At the same time he describes the quite extensive metamorphism which has affected the strata in certain regions. This fact can not well be brought into accord with such a comparatively recent age as that to which he assigns the rocks. At least nothing has been observed in Upper California, indicating that any extensive metamorphism has occurred so recently.*

Definite palæontological evidence, establishing the age of the mesa sandstones, would be very desirable, and help to clear many doubtful points in the geology of the peninsula.

PRE-CRETACEOUS ERUPTIVES.—Gabb has already remarked that eruptive masses occupy much room in the northern part of the territory, and that they overlie the granite, but from his description it is not always apparent whether these eruptives are recent or older. From the southern end of Todos Santos Bay to the boundary, they occupy large areas, but are—at least in the section from Ensenada eastward—confined to the first coast range, not extending more than twenty miles west of the shore.

On the sketch map massive eruptives occupy a large area,

* The character of the miocene series recently found in the southern part of the peninsula at Boleo (see ante p. 180, foot-note), appears to be very different from the mesa sandstones and from the Todos Santos occurrence; it also encloses volcanic materials of andesitic and basaltic character. It is probable that the shells referred to above (*ostrea*) came from a series equivalent to this and not from the mesa sandstone.

and form the rough ranges and peaks of the coast range already mentioned in the introduction. So, for instance, north of Ensenada, where they reach quite down to the sea, and continue towards the high peaks eastward; the hills east of San Carlos are also composed of eruptives; they become still more conspicuous in the high and abrupt range, south of the Maneadero, ending in Punta Banda and extending southward to Santo Tomas.

These eruptive rocks have, on the whole, a porphyritic habit, and possess the appearance of considerable geological age; they are usually dense and hard, without accompanying tufaceous masses, and contain a number of secondary minerals, especially epidote; it is further evident that they have suffered considerable erosion. The petrographic character is rather varying and will be described more minutely in another paper. At Ensenada Point the rock has a dense, almost flinty ground mass, with small feldspar crystals; between Ensenada and Sausal gray or reddish porphyrites prevail; red and black porphyrites occur in the mountains N. N. E. of Ensenada. East of San Carlos light yellowish-red quartziferous porphyries or porphyrites prevail, while normal brownish quartz porphyries may be found in the hills north of Sausal.

The Punta Banda range is composed of at least two or three different eruptives: diorites of granular structure, hornblende porphyrites with large hornblende crystals, and finally a dense reddish porphyrite.

Flow structure on a large scale is often apparent in these rocks; so, for instance, along the coast from Ensenada to Sausal, where a gray porphyrite flow about one hundred feet thick is seen to have covered a similar eruptive of a reddish color. In the hills east of San Carlos beautiful examples of this structure, on a large scale, may also be seen.

The age of these massive rocks is quite satisfactorily determined as pre-cretaceous from the above mentioned

cretaceous sandstone, which contains numerous pebbles of the same porphyrites. On the other hand, they are most likely younger than the highly compressed metamorphic slates of uncertain age in the interior.

For the present the origin and source of these enormous flows of mesozic eruptives must remain uncertain. Along the section from Ensenada eastward there are no eruptives to be seen, and it is probable that they were poured out over the granite from vents near the coast.

The presence of these effusive rocks in so large quantities forms an important feature in the geology of the peninsula, the more so as they appear to be absent, or at least little developed, in Alta California.

RECENT ERUPTIVES.—At Sausal Beach a great number of pebbles of a black vesicular basaltic rock are found, evidently derived from the large recent volcanic flows, beginning at Cape San Miguel and extending for about twenty miles up the coast. The exact age of the flows cannot as yet be determined, but judging from structure and form it must be quite recent. There are no other neo-volcanic rocks in the limits of the sketch map, and probably none for a long distance south of the bay. One hundred miles further down the coast there is a small volcanic mountain at the bay of San Quentin; from there southward, the recent eruptives are apparently more common.

SECTION FROM TODOS SANTOS BAY E. N. E. TO THE DESERT AND THE COLORADO RIVER.—(See Plates II and III.) The profile represented in fig. 1, Plate III, begins at Ensenada about fifty miles south of the boundary line and extends to the Colorado River. My own observations did not extend any farther than to the desert, and the eastern part of the section is drawn from the comprehensive view over the desert gained from the last escarpment of the mountains, aided by some notes of Professor Blake in the Pacific Railroad Reports, relating to the same territory.

It is seen at once that the section is in some respects quite similar to Blake's above mentioned profile north of the boundary line, and that it is almost exclusively made up of granite and metamorphic slates, the former much predominating.

THE FIRST OROGRAPHIC BLOCK OR THE COAST RANGE.

Leaving the small quaternary valley of Ensenada, the section runs, gently ascending, on the divide between Ensenada and Gallo Creek; to the right and left rugged masses of porphyrites rise above the granite floor. At a distance of ten miles from Ensenada the road descends in the Gallo Creek and continues along it up to the first divide. The granite is a hornblende granitite of coarse grain and white color, weathering into rounded blocks, and finally giving a sandy, barren soil. It is in composition and texture equivalent to the granite of the Sierra Nevada. The character appears to remain very constant.

Twelve miles from Ensenada, in the Gallo Cañon, metamorphic rocks are met with, extending for five miles, up to within two miles of the first divide.

In passing the contact, one gains the decided impression that the metamorphic overlies the granite; the former continues up on the hills above the cañon, while the bottom is yet in granite.

This metamorphic series is at first glance not easy to recognize as such. Passing through the cañon rapidly one would be tempted to refer it to massive rocks. The first few miles run over chloritic and micaceous slates, mixed with other very indistinctly stratified metamorphic rocks. The chloritic schist runs N.W.-S.E. to N.-S. and stands nearly vertical. Farther on the stratification ceases entirely, and brown, irregular outcrops of dense to middle-grained dark-green dioritic and diabasic rocks prevail. Approaching the eastern edge of the area this habit becomes more apparent, and the rocks ad-

joining the granite are coarse- to middle-grained diabases. Before reaching the first divide granite appears again, but the metamorphic is seen to continue, covering the granite for some little distance north of the road. How far this metamorphic belt reaches is not certain, but the probability is that it continues for quite a long distance southward. No quartz veins are seen in this zone, nor have any placers been reported from this neighborhood.

Granite forms the summit of the first range, and rises in naked cliffs a few hundred feet above the pass (2,500 feet) to the north and south of the road; it continues forming the divide, northward, at least till opposite Real del Castillo.

From the summit of the pass the view is extensive and beautiful. Six or seven hundred feet below lies the largest of the interior valleys, Valle de San Rafael, a basin-like depression about fifteen miles long north to south, and ten miles from east to west. On all sides it is surrounded by mountains, mostly bare, light-colored granitic ranges; the highest range, forming the main divide between the Pacific and the Gulf, rises directly eastward, and its summit forms a gently undulating sky line far away.

The irregular series of depressions to which the name of "the interior valleys" has been given, runs approximately north and south, and at a distance of about twenty or thirty miles from the coast. Northward it is represented by Valle de las Palmas and Guadalupe; southward it continues in the valleys of Santa Clara, Santa Catarina, and Santa Catalina; all these are separated by more or less prominent transverse ranges, and are situated at somewhat differing elevations, from 1,500 to 3,000 feet, but that they should be regarded, all together, as a result of the same or similar geological causes appears very probable.

San Rafael Valley is topographically somewhat peculiar, as it is formed by two rivers, the San Carlos and the Guadalupe, the former flowing through the southern, the latter

through the northern part of the valley, as a glance at the map (Plate II) will show. The two basins are separated by a very low range of hills, dividing the valley in two sections. Emerging from deep cañons in the eastern range the rivers pursue a winding course through the valley to break through the western or coast range in equally deep and rocky gorges. To the east and west the valley is bordered by steep mountain barriers. An especially steep granite escarpment runs along the western side from Real del Castillo southward. (See Plate II.) The road from Ensenada to the Real, which strikes the valley at its central east and west line, descends rapidly from the summit for the first few hundred feet over granite; the remaining two miles, till the level of the valley is reached, are occupied by dark, massive, more or less fine-grained dioritic rocks, which in all probability should be referred to the metamorphic series.

As soon as we reach this last-mentioned terrane very numerous quartz veins, formerly absent or scarce, are noticed. When the valley is reached the road bends northward towards Real del Castillo, and runs over the quaternary accumulations of debris forming the surface of the valley. The low range of hills separating the northern from the southern part of the valley, consists partly of granite, partly of metamorphic slates.

The little Mexican mining town of Real del Castillo lies on the Guadalupe River at the point where it leaves the valley, and enters the rocky cañons of the coast range. Some placer and even quartz gold-mining has been carried on here by the Mexicans for about twenty years.

Fig. 1, Plate V, represents a profile across the northern end of the valley at the Real. It will be seen that immediately below the steep granite escarpment to the west of the town metamorphic rocks begin, at first massive and dioritic, then decidedly slaty and composed mainly of chloritic schists, continuing for three miles eastward across the first low hills north of the valley. The strike is generally N.-S.

or N. N. W. and S. S. E., and the dip very steep, somewhat to the east; in comparatively few places, however, can either be well observed.

At the above-mentioned distance from Real there is a hot spring, with a temperature of about 100° F., containing very little mineral salt but strongly impregnated with sulphuretted hydrogen. Eastward the hills of the easterly range rise, and on their slope the metamorphic series is traversed by a great number of dikes of granite, porphyry or similar rocks. This produces a peculiar effect, as the white dikes are visible from a long distance on the hillsides, running parallel or sometimes intersecting each other like the meshes in a network. A short distance beyond this, granite appears to begin again. The whole slate series is filled with quartz veins, some of which contain gold; the larger of these veins at Real run about east and west. The granite is usually barren of gold. It is not known how far northward this slate area of Real del Castillo extends, but it is probable that it is entirely surrounded by granite, as extensive granitic areas are seen in the mountains to the north. There are several of these isolated slate areas in the northern part of the peninsula and in San Diego County. So, for instance, about fifteen miles east of Real, at the mining camp of Saragoza, according to statements of reliable informants at Real.

However, one cannot fail to be impressed by the enormous extent of the granite and the small areas occupied by metamorphic rocks. It seems evident that the slates are of but little depth and everywhere are resting, as detached fragments, one might say swimming, on the granite. Of the age of the metamorphic series, as found in or near San Rafael valley, nothing more definite can be said than that they are precretaceous, or at least older than the unaltered and nearly undisturbed rocks of the Wallala Group. On account of the extensive metamorphism it is not probable that fossils will ever be found in them. I do not, however, consider it improbable that they may be of the same age

and equivalent to the metamorphic slates of the gold-belt of the slope of the Sierra Nevada.

THE SECOND OROGRAPHIC BLOCK, OR THE SIERRA MADRE.

The profile (Plate III, fig. 1) crosses the alluvial deposits and small slate and granite knolls of San Rafael valley and continues over the second orographic block, the Sierra Madre, as it is called. Bare and white granite hills rise rather abruptly from the covering débris at their bases and the road winds upwards for five miles at a rather steep grade. The granite, of which enormous areas are seen to the north and the south, is identical in structure and composition with that of the coast range—it is a hornblende-granitite of light color and easily disintegrating.

Arrived at an elevation of 3,500 feet and five miles from the valley, one is surprised to find oneself on a gently ascending plateau, somewhat rolling and with small knolls here and there, but on the whole remarkably level; the eastern sky-line is formed by the plateau; north and south it extends for miles and miles covered with dense brush and yucca trees. At nine miles from the valley and 4,000 feet elevation, a small knoll about 100 feet high lies to the south of the road; it is entirely composed of brownish quartzite completely enclosed by the granite, a curious remainder probably of a formerly more extensive metamorphic area. The plateau becomes still more level and for a distance of about fifteen miles up to the summit, ascends but 700 feet. Beginning at 4,000 feet and extending to the divide, a belt of scattered pines relieves the monotony of the landscape. Here and there are low ranges of hills or small isolated peaks with the yellowish-white granite weathering in rounded forms. Such a range, only a few hundred feet high above the plateau and interrupted by passes at the level of the latter, forms the peninsular divide at an elevation of about 5,000 feet. The road from Real del Castillo to Campo Nacional, a small mining camp near the summit,

descends a little, ten miles from San Rafael valley, into the wide depression in the plateau in which the San Carlos river flows, and follows this up to the summit, a distance of about nine miles. The river here runs but little lower than the general surface of the plateau, which necessitates very rapid fall in the lower part of the course near San Rafael valley. The upper part for nine miles from the summit has a very inconsiderable fall; the water-course runs through a series of swamps and little lakes, and heads in a somewhat larger lake. There are no signs of glacial action. It is not possible to see just where the divide is, so level is the general surface of the country near the summit. For a few miles eastward this character is preserved and then signs of a more active erosion begin to appear. The pine forest of the plateau disappears, the water-courses are worn down into gorges and canons walled in by white, abrupt, granitic ridges; the country slopes rapidly. It is a wild landscape of bare granite hills. Finally, climbing one of the ridges, the spectator suddenly and unexpectedly finds a view extended before him which in grandeur and sublimity is surpassed by but few places on the continent. He stands at the edge of a gigantic escarpment, descending about 3,000 feet in about five miles; naked granite cliffs, separated by steep ravines and a few canons more deeply cut into the rock form the face of this escarpment: at its base the Colorado Desert spreads out, a dazzling white plain at the end of which, fifty miles away, gleams the tide water of the Colorado River at the Gulf of California. Again, far beyond this, may be seen the blue mountains of Arizona and Sonora.

The Colorado River, above the *debouchure*, is cut off from view by a lower desert range, continuing N.N.W. and running east of the great Salt Lake Magnata, a blue sheet of water on the white desert plain.

The great escarpment, facing the desert, continues northward and southward; its general trend, however, is some-

what west of north. Far to the south it is seen capped with flat-topped tables. As far as can be seen the granite extends; it forms the whole descent except near the desert where a narrow belt of a reddish rock is seen, connecting southward with dark, basaltic tables covering the desert at the foot of the escarpment. Many little ridges and isolated, low volcanic hills dot the desert in a southeasterly direction. If there is any metamorphic slate at all at the base of the range, it can be but a very narrow belt. The extent of the remarkable plateau forming the summit of the range, must be very great. To judge from statements of reliable persons this enormous granite mesa extends from near the boundary to a point fifty miles south of the profile near the old mission of Santa Catarina. At this place, Mr. R. Stevens, who has examined that country for a proposed railroad, informs me the gently sloping mesa, composed of granite, reaches 5,000 feet at the summit, while the passes are eroded deeper, and are at an elevation of about 4,000 feet. An abrupt escarpment, equally steep as at the place crossed by the profile, leads down to the desert plain, here somewhat higher, having at the base of the cliff an elevation of 2,000 feet. South of Santa Catarina, a deep valley, "Valle de la Trinidad," has cut far into the mesa; south of this the topography and geology are but very little known.

We would thus have a continuous predominantly granitic plateau bordering on the desert, twenty to forty miles broad and extending about 80 miles southward from the boundary. The descent is more or less gradual on the western side, while towards the east there is an exceedingly steep slope to the desert. On no map, as far as I am aware, has this remarkable topographic feature been properly or even approximately indicated. On the general map (Plate II) an attempt has been made to represent the great eastern escarpment. The map is based on the larger map of the coast line of Baja-California, as surveyed by the "Narragansett" in 1873; the interior topography is derived from my own

observations and some data taken from a Mexican grant map of the "Rancho Santa Catarina." It is more of a sketch than an accurate map, but it is at least approximately correct.

The granite of the plateau is petrographically very uniform. It is throughout a coarse-grained hornblende granite, or a hornblende-biotite granite, with but small local variations.

Before closing the description of the profile a few observations must be recorded which throw an additional light on some geological problems connected with the plateau.

Near the summit, about four miles east of the dividing range of hills, lies at an elevation of 4,750 feet, the little mining camp, Campo Nacional; it is directly on the line of the profile. It is situated in the pine forest of the level plateau, although in its immediate vicinity the cañons and ravines of the eastern slope begin to cut into the granite. Standing on a small elevation nothing but granite can be seen as far as the eye reaches, in all directions. Within a radius of a few miles the gulches leading down to the desert have been worked and yielded a considerable quantity of gold. The latter is coarse and well worn, and the gulches are filled with well rounded smooth pebbles of white quartz, or a dark quartzite.

This, in itself, is remarkable, as there certainly are no metamorphic rocks anywhere in the vicinity. It was soon found that all these gulches led up to a small flat-topped hill about 200 feet above the plateau, called the Black Hill. This hill is about one-half mile long, east and west, and one-eighth to one-quarter mile wide; it is made up of a well-packed mass of auriferous metamorphic gravel in very smooth boulders, often six inches in diameter. Its depth is uncertain; I was told that once a shaft had been sunk 18 feet without finding bedrock, and I should think the mass would be about 50 feet thick. The mining has been entirely confined to the ravines leading down from the hill.

That this patch of auriferous gravel has been formed by an ancient river of considerable importance is certain, but the most interesting questions are, whence did it come and to where did it flow, and where are the metamorphic rocks that furnished the material for the boulders? I saw no granite pebbles; if there are any they are very few or have been destroyed by weathering. It will be observed that the granite disintegrates very easily, and that the present rivers running through San Rafael valley carry mostly sand and but little pebbles. It was not possible to determine the direction of the fall as the bed rock is not exposed, but it is probable that the general course of the river was east and west. If so, where did it head if flowing west, or where did it go to if flowing east? The great escarpment of the range is but few miles distant. I was informed that at Camp Juarez, about 20 miles north of Campo Nacional, there are similar deposits; the gold from the two places is certainly identical. I was also told that still further north, but further down the west slope there is a similar hill near Vallecitos. Finally Mr. R. Stevens informs me that the plateau near Santa Catarina is capped with a reddish "cement," which may be a volcanic formation or a gravel deposit. Nothing definite can be said of the age of these auriferous gravels except that they certainly date from a time when the drainage and the whole topography of the peninsula were very different from what they are now. They may be tertiary and equivalent to the auriferous gravels of the Sierra Nevada. At any rate, they show conclusively that the present plateau is part of a very old continental area.

Of the desert and the desert ranges near the Colorado river I have but little to say as I did not visit them. I have sketched in the great Salt Lake and the ranges beyond, from the view obtained from the great escarpment.

These mountains of the desert are about 2,000 feet high, and apparently predominantly composed of granite on

which in places black, evidently recent, volcanic rocks rest. The range bordering the Salt Lake is probably entirely volcanic.

The desert between the foot of the escarpment and the range just mentioned above, is 20 miles wide and slopes gently from both sides to a maximum depression in the middle. The elevation of this desert at the foot of the Sierra is probably about 1,000 feet, and the center lies presumably considerably below the level of the sea. The same depression connects northward with the New River Basin, and at its northern end Prof. Blake in the Pacific Railroad Reports estimates it to be 500 feet below the surface of the sea. Southward it connects with the delta of the Colorado River by a gap in the desert range, a little south of east from Campo Nacional. Near that point it must, of course, be higher, or the river would flood the desert. South of this gap the desert ranges continue, and the average elevation of the desert itself increases.

CONCLUSIONS.

Prof. Blake's section from San Diego to the desert, referred to above (see *ante* p. 177), presents certain similarities and certain differences when compared with the one described in these notes. Both sections have a gentle west and a steep east slope, although this peculiarity is much more accentuated in the southern profile.

In both, the principal mass is composed of an enormous granitic plateau with minor areas of highly metamorphosed and compressed slates. In the former these are mainly confined to the eastern, while in the latter they are intercalated in the western slope. The large masses of mesozoic eruptives at the Pacific Coast are not represented in the northern section. The granite composing the main area appears everywhere to be identical—a white hornblende granitite similar to that of the Sierra Nevada of California.

Younger eruptives are absent in the northern section until the Colorado River is nearly reached, while near the southern section they occupy considerable areas at the foot of the great escarpment.

It is most probable that the present metamorphic areas are but small remnants compared with those that once covered the granite; the exposures along the section, such as for instance the small quartzite knoll on the plateau, or the metamorphic gravel at Campo Nacional, go far to prove that the slates everywhere rest as shallow crusts on the granite.

Considering the structural relations one cannot but believe that the great eastern escarpment is formed by an enormous fault, along which a throw of several thousand feet has taken place, and the fresh character of the fracture goes to prove that the dislocation is comparatively recent.

The occurrence of auriferous river gravel, indicating that a stream of no small dimensions once flowed near the very summit of the range, speaks very strongly for the existence of such a fault; indeed it almost proves it. A part of the course of this old channel must evidently have been cut off by the fault.

Regarding the San Rafael valley, it should be noticed that it is bordered both east and west by a rather steep escarpment, and that a line carried from the summit of the first range up to the beginning of the plateau of the Sierra Madre, would give a nearly unbroken slope for the whole peninsular range. It would, therefore, seem very plausible to consider the valley as a sunken area between two north and south faults (Graben Suess). The fact that in the section, metamorphic rocks are found near the summit of the first range, and then again at the level of the valley at the foot of the steep descent, speaks strongly in favor of this suggestion. At last, considering the structure of the whole range, one cannot fail to be impressed with its great difference from the Coast Ranges of California and its

great general similarity with the Sierra Nevada. There is the same gentle western and steep eastern slope—there is the same mainly granitic mass with smaller areas of auriferous metamorphic slate; there are finally the auriferous gravels and the recent volcanic outbursts at the eastern foot. When, going one step further, we consider that the eastern fault of the Peninsular Sierra, lies nearly in the direct S.S. E. continuation of the eastern fault of the Sierra Nevada, the intimate connection of the two ranges becomes still more apparent.

DESCRIPTION OF A NEW SUBSPECIES OF SONG SPARROW
FROM LOWER CALIFORNIA, MEXICO.

BY WALTER E. BRYANT.

Melospiza fasciata rivularis subsp. nov.

BROWN'S SONG SPARROW.*

Subsp. char. — Similar to *Melospiza fasciata fallax*, but darker and averaging larger, with longer and less robust bill.

Adult ♂ in somewhat worn breeding plumage. (Type No. 3,024, collection of Walter E. Bryant from Comondu, Lower California, March 11th, 1888.) Above, dark burnt umber more pronounced on crown and postocular stripes. Median line of crown and sides of neck, dark ashy gray. Superciliary stripe, ashy, lighter anteriorly. Edging of dorsal feathers, sides and flanks, grayish brown; dorsal feathers narrowly black centrally. Upper surface of tail, dark umber, the central ones darker along the shaft. Tertiaries, darker than tail (above) with ashy edgings. Greater wing coverts reddish brown on outer half; the inner half dark as tertiaries; some of the coverts show a blackish subterminal mark along the shaft. Under parts, grayish white. Breast, sides and crissum, heavily streaked with reddish umber. Wing, 71 mm.; tail feathers, 75 mm.; bill from nostril, 10 mm.; tarsus, 22 mm.; middle toe, 18.5 mm.

Adult ♀ in somewhat worn breeding plumage. (Type No. 3,041, collection of W. E. B. from Comondu, March 12th, 1888.) Not readily distinguished from male in coloration, but averaging smaller in size. Wing, 64.5 mm.; tail

* Dedicated to Mr. Herbert Brown of Tucson, Arizona.

feathers, 68 mm.; bill from nostril, 10 mm.; tarsus, 21 mm.; middle toe, 17 mm.

In former lists of Lower Californian birds no mention is made of finding any variety of song sparrow on the peninsula. Therefore, when I first found these birds, tolerably common along the water-course of Comondu cañon, more than a passing interest was taken in them, and a series of thirteen specimens was collected. These were found to be uniformly different from a pair of *M. f. fallax*, which I had received some time previously from Mr. Herbert Brown, and to him I sent a typical example of the Lower Californian bird for comparison with additional specimens of *fallax*. He found it to vary from anything which he had, and kindly sent me a series of fifteen song sparrows, collected at Tucson, Arizona. Ten of these are unmistakably *fallax*; the others are referable to *montana*, although probably not typical of that form, no specimen of which is at hand.

Melospiza fasciata rivularis seems to be intermediate between *montana* and *fallax*, approaching more closely the latter in coloration. The differential characters of these two extremes, as given by Mr. Henshaw,* are as follows:

Melospiza fasciata montana.—Above, umber brown, with margins of feathers gray, giving a strong grayish aspect to the plumage; back streaked with blackish brown.

M. fasciata fallax.—Above, chiefly bright reddish brown; back streaked with a darker shade of the same; streaks below, reddish, *not black*; size, smaller.

The Lower Californian sparrows are not in as fresh plumage as I could wish, but the differences are sufficiently defined to be noticed at a glance. Whether the modified shape and greater average length of bill will prove constant in a larger series of this new form remains to be determined.

Nothing peculiar in the habits or song of this bird was

*Auk, I, 224. July, 1884.

noticed that differed from other west coast song sparrows. They were not found at any locality except Comondu, which is well watered and admirably suited to their needs.

As early as the 12th of March, the females had commenced to set, but no nests were found.

A table of the measurements taken is here appended. But little dependence can be placed upon the tail measurements of either form, nearly all being in somewhat worn condition at the tips.

DIMENSIONS OF *MELOSPIZA FASCIATA RIVULARIS*, FROM COMONDU.

Collector's No.	Sex	Date, 1888	Wing	Tail feathers, ..	Bill from nostril.	Tarsus	Middle toe	Remarks
			mm.	mm.	mm.	mm.	mm.	
3024	♂	March 11.	71.5	75.	10.	22.	18.5	Type.
3045	♂	" 13.	68.5	70.5	9.5	22.	18.5	
3052	♂	" 13.	71.	72.	9.5	23.	19.	
3058	♂	" 14.	72.	73.5	10.	23.	17.5	
3108	♂	" 24.	71.	72.	9.5	21.	18.	
3157	♂	April 10.	70.	.....	9.5	22.	17.5	
3158	♂	" 10.	72.	74.	10.	21.5	18.	Typical.
3205	♂	" 16.	71.	74.	9.5	22.	19.	
		Average.	70.9	73.	9.7	22.	18.2	
3029	♀	March 12.	67.	67.	9.5	21.	17.	Type.
3041	♀	" 12.	64.5	68.	10.	22.	17.	
3042	♀	" 12.	68.	71.	9.5	21.	17.	Typical.
3156	♀	April 10.	64.	66.	9.5	21.	18.	
3176	♀	" 12.	67.	73.	9.5	20.	17.5	
		Average	66.1	69.	9.6	21.	17.3	

DIMENSIONS OF *MELOSPIZA FASCIATA FALLAX*, FROM TUCSON.

HERBERT BROWN, Collector.

Collector's No...	Sex	Date.	Wing.....	Tail feathers....	Bill from nostril.	Tarsus.....	Middle toe	Remarks.....
			mm.	mm.	mm.	mm.	mm.	
	♂	Jan. 17, 1886....	68.	73.5	8.	20.	16.	
	♂	Feb. 22, 1886....	65.	69.	8.5	20.	15.5	
	♂	" " "	68.	72.	8.5	21.	15.5	
	♂	Apr. 11, 1886....	65.	68.5	8.5	21.5	15.	
	♂	" 18, 1886....	67.	69.	9.	20.5	15.	
	♂	" " "	66.	70.5	9.	21.	16.	
	♂	May 2, 1886....	66.	73.5	9.	21.	15.5	
		Average.....	66.4	70.9	8.6	20.7	15.5	
1173	♀	Jan. 2, 1887....	60.!	66.	8.	20.	16.	
1207	♀	" 25, "	64.	71.5	8.5	21.5	16.	
1208	♀	" " "	64.	66.	8.	20.	15.5	
.....	♀	Apr. 18, 1886....	64.	70.	9.	20.5	15.5	
		Average.....	63.	68.4	8.4	20.5	15.7	

FLORA OF THE SANTA BARBARA ISLANDS.

BY T. S. BRANDEGEE.

I. ADDITIONS TO THE FLORA OF SANTA CRUZ ISLAND.

The following list contains the names of plants of Santa Cruz not specifically mentioned in Prof. E. L. Greene's Catalogue of the Flowering Plants and Ferns of the Island of Santa Cruz, published in Bulletin No. II of the Proceedings of the California Academy. A few species of Prof. E. L. Greene's Catalogue having been collected late in the season could not be determined specifically and are undoubtedly in the present list. The collection upon which this list is based, was made between the twenty-sixth of March and the first of May, at a time when the evanescent annuals and early flowering perennials were in full bloom. Most of the shrubs of the list are not common on the island, and many of them were seen in but one locality or in a single cañon. The *Quercus lobata* was small, so that *Populus Fremonti* is the only tree to be added to the flora, and only a half dozen specimens of it are growing in a southwest cañon. Continued search will add many species to the flora of this island, and not until every cañon has been thoroughly explored, can a complete list of its plants be given. I am very much indebted to Mr. Justinian Caire for permission to visit the island, and for hospitality while making the collection.

BERBERIS PINNATA, Lagasca.

DELPHINIUM PARRYI. Gray, Bot. Gazette, XII, 50.

ERYSIMUM ASPERUM, DC. Not common.

BRASSICA CAMPESTRIS, L.

ARABIS ARCUATA, Gray.

ARABIS PERFOLIATA, Lam.

SILENE CONOIDEA, L.

Determined by Dr. Sereno Watson, who says it has been found in the southern part of the State. It grows in the Santa Inez mountains, and is also found near Point Sur, below Monterey. Probably introduced from Europe, although it seems to inhabit the mountains, and not to be found about fields and dwellings.

ARENARIA DOUGLASHII, Torr. & Gray.

CALANDRINIA BREWERI, Watson.

CALANDRINIA MARITIMA, Nutt.

SIDALCEA MALVÆFLORA, Gray.

MALVASTRUM EXILE, Gray.

Decumbent, or in exposed situations, smaller and erect.

ERODIUM MACROPHYLLUM, Hook. & Arn.

GERANIUM CAROLINIANUM, L.

OXALIS WRIGHTII, Gray.

This species caespitose from a stout woody caudex, is common about Santa Barbara and along the Coast Range as far north as to San Francisco. The branches often root at the nodes, especially in damp locations and more northern habitats.

ASTRAGALUS NIGRESCENS, Nutt.

HOSACKIA GRANDIFLORA, Benth.

LUPINUS CONCINNUS, Agardh.

PICKERINGIA MONTANA, Nutt.

SPIRÆA DISCOLOR, Pursh.

ALCHEMILLA ARVENSIS, Scopoli.

SAXIFRAGA REFLEXA, Hook.

TELLIMA CYMBALARIA, Gray.

RIBES SANGUINEUM, Pursh., var. *MALVACEUM*, Gray.

RIBES MENZIESII, Pursh.

GODETIA QUADRIVULNERA, Spach.

PEUCEDANUM CARUIFOLIUM, Torr. & Gray.

GALIUM NUTTALLII, Gray.

STYLOCLINE GNAPHALIOIDES, Nutt.

MADIA DISSITIFLORA, Torr. & Gray.

BÆRIA GRACILIS, Gray.

MATRICARIA DISCOIDEA, DC.

SENECIO VULGARIS, L.

MICROSERIS LINDLEYI, Gray.

MICROSERIS ELEGANS, Greene.

MICROSERIS ANOMALA, Watson, Proc. Am. Acad., XXII, 475.

MALACOTHRIX COULTERI, Gray.

The flowers are light yellow. With it a plant having the same stout habit, large heads and general appearance, but with narrower involueral bracts, pappus wholly deciduous and receptacle naked, which seems to be a form of *M. indecora* and *squalida*, Greene.

MALACOTHRIX CLEVELANDI, Gray.

SPECULARIA BIFLORA, Gray.

GILIA NEVINII, Gray.

GILIA ANDROSACEA, Steud.

GILIA DIANTHOIDES, Endl.

NEMOPHILA AURITA, Lindl.

NEMOPHILA PARVIFLORA, Dougl.

PHACELIA VISCIDA, Torr.

PHACELIA DISTANS, Gray.

PLAGIOBOTHRYIS CANESCENS, Benth.

CONVOLVULUS PENTAPETALOIDES, L.

MIMULUS LATIFOLIUS, Gray.

MIMULUS LUTEUS, L.

CASTILLEIA PARVIFLORA, Bong.

APHYLLON FASCICULATUM, Gray.

AUDIBERTIA NIVEA, Benth.

AUDIBERTIA STACHYOIDES, Benth.

SCUTELLARIA TUBEROSA, Benth.

SALICORNIA AMBIGUA, Michx.

POPULUS FREMONTI. var. WISLIZENI, Watson.

QUERCUS LOBATA, Née.

ALLIUM HYALINUM, Curran.

Common throughout the island.

ALLIUM LACUNOSUM, Watson.

These two species of *Allium* were determined by Dr. Sere-
no Watson.

CALOCHORTUS ALBUS, Dougl.

CALOCHORTUS VENUSTUS, Benth.

BRODLÆA MINOR, Watson.

LUZULA COMOSA, Meyer.

CAREX GLOBOSA, Boot.

PHALARIS INTERMEDIA, Bosc.

TRisetum BARBATUM, Steud.

KœLERIA CRISTATA, Pers.

STIPA SETIGERA, Presl.

STIPA EMINENS, Cav.

STIPA VIRIDULA, Trin.

FESTUCA TENELLA, Willd.

FESTUCA MICROSTACHYA, Nutt.

BROMUS HOOKERIANUS, Thurb.

BROMUS CILIATUS, L.

POA ANNUA, L.

POA HOWELLII, V. & S.

Determined by Dr. Geo. Vasey.

EQUISETUM TELMATEIA, Ehrh.

GYMNOGRAMME TRIANGULARIS, Kaulf.

CHEILANTHES MYRIOPHYLLA, Desv.

ADIANTUM EMARGINATUM, Hook.

SELAGINELLA RUPESTRIS, Spring.

II. FLORA OF SANTA ROSA ISLAND.

The collection of Santa Rosa plants herein enumerated was made during the first ten days of June. The early vegetation had already disappeared and the Island had assumed the dry appearance common to western California after the spring rains have passed. Only the eastern and northern parts were visited, and doubtless an examination of the whole island earlier in the season will add a large number of species to its flora.

To the owner of the island—Mr. Alexander P. More, a member of this Academy—for opportunity to make the collection and for facilities given, I am very greatly obliged.

CLEMATIS LIGUSTICIFOLIA, Nutt.

On Santa Cruz Island the flowers of some plants are perfect, and the vines become three inches in diameter.

RANUNCULUS CALIFORNICUS, Benth.

DELPHINUM PARRYI, Gray.

ESCHSCHOLTZIA CALIFORNICA, Cham. = *E. glauca*, Greene.

Eschscholtzias are very abundant on both Santa Rosa and Santa Cruz Islands, and the plants not only differ in habit, color of foliage and of flowers, but the same plant sometimes undergoes an almost specific change in general appearance. Tall, large plants on Santa Cruz Island, having very glaucous foliage and graceful habit, by the end of April had become stiff and branching, had assumed a reddish brown color throughout, and the flowers had changed from light yellow to deep orange. The color of the plants seems to depend somewhat upon the moisture of the soil, as is shown by a gradation from the glaucous ones near the bottom of cañons to the red-brown ones of the dry sides. On the loose soil of steep slopes the same plant seems to persist as an annual and become *E. peninsularis*, Greene.

Some of the seaward slopes of Santa Rosa Island abound with *Eschscholtzias* varying in color from red-brown to extremely glaucous. The flowers are of all shades of color between light yellow and deep orange, and vary much in size.

DENDROMECON RIGIDUM, Benth. = *D. Hayfordii*, Kellogg, and *D. flexile*, Greene.

This shrub on Santa Rosa varies from forms having oval leaves with smooth margins to those having lanceolate leaves with rough margins. Sheltered from the wind it becomes *D. flexile*, Greene, but when exposed the leaves are smaller, narrower and rougher.

PLATYSTEMON CALIFORNICUS, Benth.

CHEIRANTHUS ASPER, Cham. & Schlecht.

Seeds slightly winged. A form in situations sheltered from the wind resembles *Erysimum asperum* in habit.

ERYSIMUM INSULARE, Greene.

SISYMBRIUM REFLEXUM, Nutt.

LEPIDIUM LASIOPHYLLUM, Nutt.

CAPSELLA DIVARICATA, Walp.

ISOMERIS ARBOREA, Nutt.

VIOLA PEDUNCULATA, Torr. & Gray.

HELIANTHEMUM SCOPARIUM, Nutt.

Prostrate-spreading when growing in situations exposed to the wind.

FRANKENIA GRANDIFLORA, Cham. & Schlecht.

SILENE LACINIATA, Cav. = *S. simulans*, Greene.

Very common on both Santa Cruz and Santa Rosa Islands. Plants vary from a few inches to four feet in height.

SILENE GALLICA, L.

SAGINA OCCIDENTALIS, Watson.

STELLARIA MEDIA, Smith.

LEPIGONUM MACROTHECUM, Fisch. & Meyer.

PENTACÆNA RAMOSISSIMA, Hook.

CLAYTONIA PERFOLIATA, Donn.

A form of this species having linear leaves is not uncommon on Santa Cruz Island. One specimen collected has the flowers glomerate on the disk and several linear radical leaves with one broadly deltoid.

SIDALCEA MALVÆFLORA, Gray.

MALVA BOREALIS, Wallm.

ERODIUM CICUTARIUM, L'Her.

CEANOTHUS CRASSIFOLIUS, Torr.

CEANOTHUS ARBOREUS, Greene.

Smaller than on Santa Cruz Island, and hardly more than a bush in appearance. Leaves nearly entire and smooth. An interesting form indicating its mainland representative.

RHUS DIVERSILOBA, Torr. & Gray.

RHUS INTEGRIFOLIA, Benth. & Hook.

HOSACKIA STRIGOSA, Nutt.

HOSACKIA MARITIMA, Nutt.

HOSACKIA GLABRA, Torr. = *Syrmatium dendroideum*, Greene.

Some of its forms are exactly the mainland plants.

VICIA AMERICANA, Mühl.

LUPINUS CHAMISSONIS, Esch.

LUPINUS MICRANTHUS, Dougl. = *L. umbellatus*, Greene.

The plants are slightly more spicate than those of Santa Cruz Island, and the mainland plants are not different from those of both Islands.

TRIFOLIUM TRIDENTATUM, Lindl.

ASTRAGALUS LEUCOPSIS, Torr. & Gray.

ASTRAGALUS MIGUELENSIS, Greene.

Very abundant in some localities. It is probably a variety of *A. leucopsis*.

MELILOTUS PARVIFLORA, Desf.

PRUNUS ILICIFOLIUS, Walp., var. OCCIDENTALIS (Lyon).
= *P. occidentalis*, Lyon.

On Santa Rosa Island it is confined to the bottom of the cañons, and is much larger and more tree-like than on Santa Cruz Island. On Santa Cruz it sends up several trunks from one root and resembles a big bush, but on Santa Rosa a single trunk ascends sometimes fifteen feet before it begins to branch. The leaves are generally more or less sinuate-dentate and sometimes entire. In the Santa Inez Mountains, near Santa Barbara, the leaves sometimes have entire margins and it becomes six inches in diameter and attains a height of fifteen feet. A large specimen near San Francisco has a diameter of more than two feet.

RUBUS URSINUS, Cham. & Schlecht.

ADENOSTOMA FASCICULATUM, Hook. & Arn.

Spreading-prostrate in situations exposed to the wind.

ROSA CALIFORNICA, Cham. & Schlecht.

HETEROMELES ARBUTIFOLIA, Roemer.

LYONOTHAMNUS ASPLENIFOLIUS, Greene.

Not common. The trees are small and often distorted by the wind. This species always forms small groves of a hundred more or less trees. It sends up several trunks from one crown, and the whole grove probably is connected underground by its roots.

HEUCHERA PILOSISSIMA, Fisch. & Meyer. = *H. maxima*, Greene.

Not uncommon throughout Santa Cruz Island and very abundant in the cañons of Santa Rosa. When growing amongst bushes on Santa Cruz the flowering stems reach a height of five feet. On sun-exposed rocks it is often not more than six inches high.

TILLÆA MINIMA, Miers.

COTYLEDON LANCEOLATA, Watson.

ÆNOTHERA BISTORTA, Nutt.

ÆNOTHERA DENTATA, Cav.

ÆNOTHERA CHEIRANTHIFOLIA, Horn.

Many forms, one of which is *E. nitida*, Greene.

ZAUSCHNERIA CALIFORNICA, Presl.

GODETIA QUADRIVULNERA, Spach.

CLARKIA ELEGANS, Dougl.

MENTZELIA MICRANTHA, Torr. & Gray.

ECHINOCYSTIS FABACEA, Naudin.

The plants of both Santa Cruz and Santa Rosa Islands seem to be this species rather than *E. macrocarpa*. They mature either four or eight large seeds.

OPUNTIA ENGELMANNI, Salm., var. (?) LITTORALIS, Engelm.

MESEMBRIANTHEMUM CRYSTALLINUM, L.

Very abundant.

DAUCUS PUSILLUS, Mx.

PEUCEDANUM CARUIFOLIUM, Torr. & Gray.

SAMBUCUS GLAUCA, Nutt.

SYMPHORICARPOS MOLLIS, Nutt.

LONICERA HISPIDULA, Dougl., var. VACILLANS, Gray.

GALIUM APARINE, L.

GALIUM NUTTALLII, Gray. = *G. Miguelense*, Greene.

Climbing high amongst bushes, or less luxuriant on rocky hillsides, or depressed prostrate when exposed to the wind, and then it becomes *G. Miguelense*. Berry shining white.

GALIUM ANGUSTIFOLIUM, Nutt.

GRINDELIA GLUTINOSA, Dunal. = *G. latifolia*, Kellogg.

Referred to this species by Dr. Gray. Small specimens are the same as some from the mainland. The involucre is more or less squarrose and the akenes are auriculate-bordered. Pappus awns 2—3, and sparingly ciliolate-scabrous. Very balsamic-viscid during anthesis.

BIGELOVIA VENETA, Gray.

SOLIDAGO CALIFORNICA, Nutt.

CORETHROGYNE FILAGINIFOLIA, Nutt.

DIPLOSTEPHIUM CANUM, Gray. = *Hazardia cana, serrata* and *detonsa*, Greene.

Leaves vary in outline from sharply serrate and crenate to almost entire.

ERIGERON FOLIOSUS, Nutt.

ERIGERON GLAUCUS, Ker.

ERIGERON SANCTARUM, Watson, n. sp. in litt.

Santa Inez Mountains, near Santa Barbara and Santa Rosa Island.

ASTER FOLIACEUS, Lindl.

BACCHARIS PILULARIS, DC.

BACCHARIS DOUGLASII, DC.

STYLOCLINE GNAPHALIOIDES, Nutt.

FILAGO CALIFORNICA, Nutt.

GNAPHALIUM PURPUREUM, L.

GNAPHALIUM DECURRENS, Ives, var. *CALIFORNICUM*, Gray.

GNAPHALIUM SPRENGELII, Hook. & Arn.

LEPTOSYNE GIGANTEA, Kellogg.

MADIA SATIVA, Molina.

HEMIZONIA FASCICULATA, Torr. & Gray.

HEMIZONIA PANICULATA, Gray.

LAYIA PLATYGLOSSA, Gray.

VENEGASIA CARPESIOIDES, DC.

BERIA GRACILIS, Gray.

BERIA PALMERI, var. *CLEMENTINA*, Gray.

The specimens from Santa Rosa Island are more fleshy-thickened and the bracts more strongly carinate than those from Santa Cruz. Pappus of the disk flowers generally of four, sometimes of as many as seven paleæ; of the ray flowers mostly two, often one and sometimes none, similar to the pappus of *B. gracilis* from the Islands and Santa Barbara.

ERIOPHYLLUM STÆCHADIFOLIUM, Lag.

CHÆNACTIS TENUIFOLIA, Nutt.

AMBLYOPAPPUS PUSILLUS, Hook. & Arn.

ANTHEMIS COTULA, L.

ACHILLEA MILLEFOLIUM, L.

ARTEMISIA CALIFORNICA, Less.

ARTEMISIA LUDOVICIANA, Nutt.

CNICUS OCCIDENTALIS, Gray. = *C. lilacinus*, Greene.

This species on Santa Cruz Island has the involucre bracts strongly incurved; on Santa Rosa, either straight or strongly incurved; in the Santa Inez Mountains, sometimes strongly incurved, commonly slightly incurved and often straight. The Santa Rosa Island plants having strongly incurved bracts to the first large flowers, often have straight ones to the smaller heads that are produced later in the season.

CENTAUREA MELITENSIS, L.

PEREZIA MICROCEPHALA, Gray.

STEPHANOMERIA VIRGATA, Benth.

Annual, from six inches high upward; leaves more or less resinous dotted; pappus white, fragile and easily separating from the akene; including *S. tomentosa*, Greene, and probably *S. elata*, Nutt.

STEPHANOMERIA EXIGUA, Nutt.

Annual, pappus bristles more persistent, more or less dilated at base and united into phalanges, and often with setæ intermixed.

MICROSERIS LINEARIFOLIA, Torr. & Gray.

Plants which would be referred to *M. macrochaeta*, Gray,

were collected and are evidently a form of *M. linearifolia*. Robust plants with strong fruiting heads of *M. linearifolia* sometimes send up from near the base scapes bearing heads with the pappus of *M. macrochaeta*. The fruit of the *M. macrochaeta* form seems always to be undeveloped.

MICROSERIS LINDLEYI, Gray.

MALACOTHRIX INCANA, Torr. & Gray.

MALACOTHRIX SAXATILIS, Torr. & Gray.

HIERACIUM ARGUTUM, Nutt.

TROXIMON GRANDIFLORUM, Gray.

SONCHUS OLERACEUS, L.

SONCHUS ASPER, Fuchs.

ARCTOSTAPHYLOS TOMENTOSA, Dougl.

ARCTOSTAPHYLOS PUNGENS, HBK. = *A. insularis*, Greene.

ARCTOSTAPHYLOS DIVERSIFOLIA, Parry.

DODECATHEON HENDERSONI, Gray.

ERYTHRÆA DOUGLASII, Gray.

GILIA ATRACTYLOIDES, Steud.

GILIA ANDROSACEA, Steud.

GILIA NEVINII, Gray.

ELLISIA CHRISANTHEMIFOLIA, Benth.

PHACELIA DISTANS, Benth. = *P. scabrella*, Greene.

Calyx lobes rarely incised. Leaves not as finely and compoundly dissected as they are in the common forms.

PHACELIA VISCIDA, Torr.

PHACELIA RAMOSISSIMA, Dougl.

KRYNITZKIA LEOCARPA, Fisch. & Meyer.

AMSINCKIA INTERMEDIA, Fisch. & Meyer.

CONVOLVULUS MACROSTEGIUS, Greene.

DICHONDRA ARGENTEA, Willd. (?)

SOLANUM NIGRUM, L., var. DOUGLASII, Gray.

SOLANUM XANTI, var. WALLACEI, Gray.

LINARIA CANADENSIS, Dum.

ANTIRRHINUM NUTTALLIANUM, Benth.

COLLINSIA BICOLOR, Benth.

PENTSTEMON CORDIFOLIUS, Benth.

MIMULUS GLUTINOSUS, Wendl. = *M. puniceus*, Steud.,
Diplacus arachnoides and *parviflorus*, Greene.

Abundant on both Santa Cruz and Santa Rosa Islands:
very variable, with all the forms and colors running into
each other.

MIMULUS LUTEUS, L.

MIMULUS NASUTUS, Greene.

CASTILLEIA PARVIFLORA, Bong.

CASTILLEIA HOLOLEUCA, Greene.

Answers to the description of *C. foliolosa*, Hook. & Arn.,
in the Synoptical Flora, but differs from the Santa Inez
forms in the character of its pubescence. Its calyx is near-
ly equally cleft and the bracts are usually red.

ORTHOCARPUS PURPURASCENS, Benth.

APHYLLON TUBEROSUM, Gray.

SPHACELE CALYCINA, Benth. = *S. fragrans*, Greene.

SALVIA COLUMBARIE, Benth.

AUDIBERTIA STACHYOIDES, Benth. var. REVOLUTA.

Margins of the leaves revolute, giving to the bush a peculiar appearance.

STACHYS BULLATA, Benth. = *S. acuminata*, Greene.

PLANTAGO PATAGONICA, Jacq.

ERIOGONUM NUDUM, Dougl. = *E. grande* and *rubescens*, Greene.

The rose-colored variety is the form of Santa Rosa Island, and differs only in color from my Santa Cruz specimens, and both agree with mainland forms.

ERIOGONUM ARBORESCENS, Greene.

RUMEX SALICIFOLIUS, Weinm.

POLYGONUM AVICULARE, L.

CHORIZANTHE STATICOIDES, Benth.

PTEROSTEGIA DRYMARIOIDES, Fisch. & Meyer.

ABRONIA UMBELLATA, Lam.

CHENOPODIUM AMBROSIoidES, L.

CHENOPODIUM ALBUM, L.

ATRIPLEX CALIFORNICA, Moquin

SUÆDA TORREYANA, Watson.

SALICORNIA AMBIGUA, Michx.

PARIETARIA DEBILIS, Forst.

SALIX LÆVIGATA, Bebb.

POPULUS TRICHOCARPA, Torr.

QUERCUS DUMOSA, Nutt.

QUERCUS LOBATA, Née.

QUERCUS TOMENTELLA, Engelm.

Common in cañons on the east and north sides. Larger than on Santa Cruz Island.

QUERCUS AGRIFOLIA, Liebm.

PINUS INSIGNIS, Dougl., var. BINATA, Engelm.

PINUS TORREYANA, Parry.

The Forestry Report of the Tenth Census gives a station near San Diego as the only certain habitat of this pine and adds that it is doubtfully reported from Lower California and one of the islands off Santa Barbara. About one hundred trees are growing on the bluffs of the eastern shore.

HABENARIA ELEGANS, Bolander.

SISYRINCHIUM BELLUM, Watson.

ALLIUM LACUNOSUM, Watson.

BLOOMERIA AUREA, Kellogg.

BRODIAEA CAPITATA, Benth. = *B. insularis*, Greene.

Plants no different from the island forms and equally as tall and broad leaved flourish in favorable situations of the Santa Inez Mountains.

LILIUM HUMBOLDTII, Rœzl. & Leicht.

CALOCHORTUS ALBUS, Dougl.

ZYGADENUS FREMONTI, Torr.

PHYLLOSPADIX TORREYI, Watson.

LUZULA COMOSA, Meyer.

JUNCUS BUFONIUS, L.

JUNCUS PATENS, Meyer.

JUNCUS BALTICUS, Dethard.

SCIRPUS PUNGENS, Vahl.

CAREX DOUGLASII, Boott.

POLYPOGON MONSPELIENSIS, Desf.

STIPA SETIGERA, Presl.

AGROSTIS VERTICILLATA, Vill.

AGROSTIS SCOULERI, Trin.

Determined by Dr. George Vasey.

KÆLERIA CRISTATA, Pers.

DISTICHLIS SPICATA, L.

BROMUS HOOKERIANUS, Thurb.

ELYMUS CONDENSATUS, Presl.

AGROPYRUM REPENS, Beauv.

HORDEUM MURINUM, L.

FESTUCA MICROSTACHYS, Nutt.

FESTUCA MYURUS, L.

POLYPODIUM CALIFORNICUM, Kaulf.

PELLÆA ANDROMEDÆFOLIA, Fée.

CHEILANTHES MYRIOPHYLLA, Desv.

GYMNOGRAMME TRIANGULARIS, Kaulf.

PTERIS AQUILINA, L.

ADIANTUM EMARGINATUM, Hook.

ASPIDIUM RIGIDUM, Swartz.

III. COMPARISONS BETWEEN THE FLORAS OF SANTA CRUZ AND
SANTA ROSA ISLANDS AND THE SANTA INEZ MOUNTAINS.

Prof. E. L. Greene in his "Studies in the Botany of California and parts Adjacent," published by the California

Academy of Sciences, Vol. 2, No. 7, brought to notice the occurrence on the island of Santa Cruz of several trees, either peculiar to the Californian insular flora or endemic upon the island itself, and to add representatives of these trees to the Jesup Wood Collection of New York, Prof. C. S. Sargent asked me to go to the island and endeavor to obtain them.

This opportunity to study the insular flora was gladly embraced, and six weeks were spent in making a botanical collection from all parts of the island; then to add to my knowledge obtained from Santa Cruz and to enjoy the pleasure of exploring an island almost wholly unknown botanically, a visit was made to the adjoining island of Santa Rosa. At different times, collections of plants with especial reference to the insular floras were made in the Santa Inez Mountains representing the vegetation of the ocean slope of this coast range within a dozen miles or more of Santa Barbara.

The general trend of the mainland coast from Santa Barbara to Point Conception is westerly, and about twenty-five miles to the south and nearly parallel to it, lie the islands of Santa Cruz, Santa Rosa and San Miguel. Santa Cruz, the largest in area and most easterly, is long and narrow in shape, rugged and mountainous in profile, with its surface much broken by deep, rocky cañons.

Santa Rosa, nearly as large as Santa Cruz, occupies a central position, distant from the other two islands about ten miles; is more nearly circular, or perhaps, rectangular in outline, having a width of about twelve miles; the central hills or peaks reach an altitude of about 1200 feet, not more than half that of the Santa Cruz mountains; its surface slopes from the highest points to the shore, and is somewhat broken by cañons and gulches.

San Miguel, the most westerly, is a small island of low elevation.

The situation and topography of the islands in connection with the prevailing winds, determine the variety of their

flora and also somewhat the form and habit of the species.

The distorted trees, the prostrate spreading bushes and the encroaching sand dunes show plainly that the wind most affecting the vegetation comes from the north and northwest.

Santa Cruz, on account of its easterly location, receives more protection from the Santa Inez Mountains against the north winds than Santa Rosa, and the high mountains of the island itself afford additional shelter to the plants and trees of its valleys and cañons. Its large area, its sheltered position and its physical characteristics account for the large number of species growing upon Santa Cruz Island.

San Miguel, the westerly member of this group of islands, is almost wholly unprotected by the mainland coast, and receives the full force of the northwest winds.

Santa Rosa, situated to the windward of Santa Cruz, and consequently receiving less protection from the northern coast, with its topography not so mountainous or so varied, possesses a flora smaller in number of species, and as it partakes somewhat of the conditions of both the adjoining islands its flora is a mixture of that of those two islands; the eastern side approaching nearly to the conditions of Santa Cruz, its flora is mainly of species growing upon that island, while the western side approaching San Miguel in situation and physical characteristics resembles it in general botanical features. The shrubby vegetation and trees of Santa Rosa, are nearly all confined to the sheltered hill-sides and cañons of the eastern portion of the island.

Many of the plants of the islands vary in their form and habit more or less from those of the same species growing upon the neighboring mainland, and those of one island often differ much from those of another, and even upon the same island some species present a width of variation, the extreme limits of which appear distinct. The species of Santa Rosa, as would be expected from the conditions of their existence, vary not only from those of the mainland

and Santa Cruz but even extremely upon the island itself. These local variations upon the islands are caused mainly by more or less exposure to the strong and almost incessant northerly winds. A fine example of this class of variation is afforded by the *Dendromecon* of Santa Rosa, which, according to its location, assumes the mainland form with narrow, rough-edged, or the insular form of Santa Cruz, with broad, smooth-margined leaves.

The variation of a plant of one island from its form upon another island is always interesting, often puzzling, and from the lack of connecting forms is, in many instances, considered specific. The two species of the insular genus *Lyonothamnus*, one from the island of Santa Catalina, and the other from Santa Cruz and Santa Rosa, are so closely related, that, as far as known, their specific distinctness rests only upon the form of the leaf, and the closeness of their relationship is still further strengthened by the fern-like divisions of *L. asplenifolius* appearing upon many of the leaves of *L. floribundus*.

The two species of *Lyonothamnus* will probably be considered distinct, and the great extent of water separating the islands renders the existence of connecting forms doubtful.

But *Ceanothus arboreus* of Santa Cruz and its representative upon Santa Rosa, are examples of different forms of different islands that can hardly be considered specifically distinct, although the specimens are apparently as much so as those of many received species of this genus.

Between these examples of extreme variation and the larger number of plants which retain upon the different islands a similar form, numerous instances of more or less deviation might be given.

Insular variation, or the variation of the island species from their mainland representatives, is more complicated, but seems mainly either to be the result of an insular climate or a separation of their respective habitats for a long

interval of time, and sometimes of a combination of both causes.

The intervening miles of restless ocean rendering the existence of connecting forms between a species of the mainland and its insular form improbable, tends to give recognized specific rank to forms which on the mainland would hardly be considered good varieties and accounts for many of the so called endemic species of islands.

The direct effects of an insular climate upon vegetation, with least intervention from other forces, are best shown upon Santa Cruz and in the protected cañons of Santa Rosa.

No general rule will apply to all plants, but different species and genera seem to be variously influenced by the climatic conditions.

As by far the larger part of the island flora is composed of the maritime and Coast Range plants, species that delight in ocean breezes, spray and fogs, it is not surprising that many of them, in the midst of such conditions, should often become very luxuriant. Of course difference of size is not a specific difference, but often this insular luxuriance obscures the close relationship, which, on that account, is sometimes best shown by insular depauperate specimens, as in the case of *Brodiaea capitata*, the Santa Rosa *Grindelia*, and other species.

An interesting fact in connection with insular variation, and one that is not easily accounted for, is the tendency that mainland shrubs and bushes show on the islands not to develop their lower limbs and branches and therefore become tree-like. The most conspicuous examples of these tree-like bushes are *Prunus ilicifolius*, *Cercocarpus*, *Rhus*, *Rhamnus*, *Ceanothus*.

An insular form is not always a more luxuriant, but sometimes is what may be considered a degenerate form: a good illustration of this sort of variation is afforded by

Malacothrix Coulteri, which is, however, not a Coast Range plant. This plant, on the eastern end of Santa Cruz Island, is found in its mainland form, and growing with it plants varying toward *M. insularis*, which, in exposed situations, might easily become *M. squalida* or *indecora*.

A species which can flourish in the Sierra Nevada mountains, withstand the extreme summer heat of the central valleys, and also grow amongst the fogs of the Coast Range and adjacent islands, must reflect somewhat in its characters the very diverse conditions under which it exists. The extreme differences of climate that are found within a few miles distance make the flora of California a flora of variable species, a flora that should be studied in the field or with abundant material from many localities. The division of the year into wet and dry seasons induces a form of variation which it may be not out of place to notice, especially as it has some connection with insular plants; it is that many perennial species undoubtedly also persist as annuals if they are able to mature their seed before the summer's drought kills them. This peculiarity is alluded to by Dr. Engelman in the Botanical Gazette, Vol. VI, 235, with reference to *Eschscholtzia*.

The great extent of coast line of the islands, Santa Cruz having over fifty miles and Santa Rosa more than forty, compared with their area, affords a large habitat for a maritime flora, and plants most abundant in the vicinity of salt water, form a large proportion of the insular flora. This is more noticeable on the sloping hills of Santa Rosa than on the bold and rocky shores of Santa Cruz, and accounts for the seemingly great preponderance of such sea-shore plants as *Eschscholtzia*, *Cotyledon*, *Abronia*, *Mesembrianthemum*, and others.

The insular floras should be compared with those of the neighboring shore and coast range rather than with that of

California in general, and then the absence of certain genera and species does not appear so remarkable.

The summit of the coast range seems to be a barrier that limits the habitat of many species, but there are a few from the interior not found in the Coast Range flora that unexpectedly reappear upon the islands.

The known flora of Santa Cruz and Santa Rosa Islands now numbers close upon four hundred species, that of Santa Cruz amounting to three hundred and eighty, and that of Santa Rosa to nearly two hundred species, with only twenty found upon Santa Rosa that have not been reported from Santa Cruz.

If the insular endemic flora of these islands is supposed to number twenty species, some doubtful ones must be included: nine of these twenty endemic species inhabit also Santa Catalina and Guadalupe Islands, leaving eleven or less, peculiar to Santa Cruz, Santa Rosa and San Miguel.

Of the remaining three hundred and eighty species, over three hundred and fifty-five grow about Santa Barbara and in the adjoining Santa Inez mountains, leaving twenty-five species still to be accounted for, which, with the present knowledge of their distribution may be considered as belonging to the San Diego flora, or in a few instances, to the plants of the interior region.

The following notes and observations concerning mainland and insular plants having, perhaps, sufficient value to be worthy of publication, are here appended:

DELPHINIUM PARRYI, Gray. Bot. Gazette, XII, 50.

This seems to be the most common species of the Santa Inez mountains, and is abundant upon the islands.

PLATYSTIGMA CALIFORNICUM, Benth. & Hook. = *P. denticulatum*, Greene.

The island specimens are more denticulate than the more or less denticulate forms of the mainland.

THYSANOCARPUS LACINIATUS, Nutt. = *T. ramosus*, Greene.

CALANDRINIA BREWERI, Watson.

Appears to be more abundant upon Santa Cruz Island than on the mainland.

RHAMNUS CROCEA, Nutt. = *R. insularis*, Kellogg.

The large leaved island *Rhamnus* is abundant in the Santa Inez mountains at the higher elevations, but is always a bush less than six feet in height. A smaller leaved form grows at lower elevations.

This species in some localities of the more northern portions of the State, with the habit of a bush, becomes as tall as upon Santa Cruz, where it is a fine example of a mainland bush becoming an insular tree.

RHUS OVATA, Watson.

All the species of *Rhus* are larger and more tree-like upon the island than on the mainland, even *R. diversiloba* almost becomes a small tree. In some of the southwest cañons of Santa Cruz near the sea, *R. ovata*, with a single trunk and compact rounded head, resembled in appearance small apple trees, and in full bloom presented a fine appearance, very different from the bush of the summits of the mainland mountains. It is one of the very first to start forth anew from its roots after all vegetation has apparently been killed by fire.

CERCOCARPUS PARVIFOLIUS, Nutt. = *C. betulcefolius*, Nutt.
A mainland shrub that often is an insular tree.

GALIUM CALIFORNICUM, Hook. & Arn. = *G. flaccidum*, Greene.

As noted in the Flora of California this species often has a pubescent ovary, and the pubescence sometimes persists upon the mature white fruit.

AUDIBERTIA STACHYOIDES, Benth.

Common about Santa Barbara and on Santa Cruz Island.

The Santa Barbara specimens, perhaps, collected from a single bush are pistillate, with no trace of stamens.

CALOCHORTUS ALBUS, Dougl.

Is white flowered upon the mainland, and light-purple flowered upon Santa Cruz.

BOTANICAL NOTES.

BY MARY K. CURRAN.

I. *Plants from Baja California.*

The following small but very interesting collection of plants was made by Mr. Walter E. Bryant, already well known as an ornithologist, who spent some of the early months of this year in the vicinity of Magdalena Bay, studying and collecting the mammals and birds of that region. Several plants have been omitted from the list, being generically undeterminable because imperfect; and many are specifically so, for the same reason, or for lack of the necessary literature.

ARGEMONE MEXICANA L. var. ALBA.

SISYMBRIUM CANESCENS Nutt.

SISYMBRIUM, sp.

LEPIDIUM NITIDUM Nutt.

LYROCARPA COULTERI Hook. & Harv.

BISCUTELLA, sp.

OLIGOMERIS SUBULATA Boiss.

KRAMERIA PARVIFOLIA Benth.

DRYMARIA VEATCHII.—Prostrate-spreading, minutely pubescent; leaves ovate, tapering into slender petioles of about the same length and together with the flowers, fascicled in the axils; pedicels slender, 2-8 lines long; sepals concave oblong-ovate with broad scarious margins; petals nearly twice the length of the sepals, 6-8-lobed, the outer lobes rather large, spatulate, longer than the rest, and extending downward as an undulate margin to the claw, the intermediate ones linear or lanceolate: seeds dark-brown, strongly curved.

First collected by Dr. Veatch, on Cedros Island—his fragmentary specimen so much resembling *Mollugo verticillata* that it has been overlooked till Mr. Bryant's specimens came to hand.

FOUQUIERA FORMOSA HBK.

GOSSYPIUM DAVIDSONII Kell.

MALVASTRUM, sp.

MALVASTRUM, sp.

ANODA HASTATA Cav.

SPHÆRALOEA, sp.

ABUTILON, sp.

HIBISCUS, sp.

MELOCHIA, sp.

EAGONIA CALIFORNICA Benth.

LARREA MEXICANA Moric.

Staphylea geniculata Kell. *Viscainoa geniculata* Greene. Flowering specimens of this obscure plant have lately been collected by C. R. Orcutt (distributed under name *Chitonia simplicifolia* Watson), by Dr. Palmer, and now by Mr. Bryant. The description appended is drawn from this fuller material. Fruiting specimens seem to have been collected only by Dr. Veatch.

Shrubby, low and branching, pubescent or nearly glabrous: leaves alternate sessile or short-petioled, entire (ovate lanceolate to cuneate-obovate, obtuse or retuse) or 2-4 pinnate with entire uneven leaflets, after the manner of *Larrea*; stipules small, subulate, caducous: flowers hermaphrodite: peduncles rather short, stout, 1-flowered, opposite the leaves, deflexed: sepals 4-6, uneven, imbricate, deciduous: petals pale-yellow, nearly orbicular, 4-6 lines long: disc obscure: stamens 8: filaments naked, subu-

late; anthers versatile: ovary villous, somewhat stipitate, 3-6-lobed, 3-6-celled; styles short, coherent, as many, and stigma as many lobed as there are carpels in the ovary; ovules anatropous, two in each cell, pendulous from the inner angle; micropylar extremity produced upward, as in the figure of *Guaiacum*, Gray's Genera, but in less tubular shape (in the description of *Viscainoa* mentioned as a "small hemispherical white strophiole"); raphe ventral; fruit more or less pubescent, 3-6 lobed, $\frac{3}{4}$ -1 inch long, tipped by the stout styles; carpels coriaceous, separating at maturity from each other, navicular (in dehiscence), opening along the inner angle, and remaining attached by slender threads to the upper part of the axis formed by the united placentae: seeds two in each carpel, remaining suspended from above the middle of the axis, ovoid, with a fleshy green or glaucous testa and thin dark-brown tegmen; albumen corneous-cartilaginous, rimose; embryo nearly straight in the axis of the albumen almost as long as the seed; cotyledons nearly orbicular, foliaceous, or a little fleshy, curved at the apex, their edges directed to the raphe and to the axis of the fruit, radicle short, conical, superior.

It will be observed that the description of the seed is almost exactly that of *Guaiacum* by Dr. Gray in Gen. of Am. Plants—even the wording has been intentionally followed in order to still more emphasize their resemblance.

Some curious errors which appear in the earlier descriptions are herein corrected. Dr Kellogg, in the original notice, states that there are pellucid dots in the leaves; a careful examination of these makes it probable that he was misled by small gummy exudations. The errors of the second description (*Viscainoa*), which contains the following statements: "testa dull and dark-brown; embryo very small at the base of a copious hard-cartilaginous or almost corneous albumen; cotyledons rounded, somewhat convolutely enfolding the short blunt radicle"—are more vital and quite incomprehensible in the light of the author's succeeding

remark—"Concerning this rare and curious shrub of the Lower Californian peninsula no new knowledge is forthcoming beyond what has been gained by a minute and thorough examination of the good fruiting specimens collected by Dr. Veatch, almost thirty years ago, and now preserved in the herbarium of the California Academy of Sciences, Pittonia I., 163." Equally at variance with the facts are the deductions drawn from the merely external appearance of the capsules, on account of which it was relegated to the Euphorbiaceæ and placed near *Simmondsia*. Its true place is certainly in Zygophyllaceæ between *Guaiacum* and *Chitonia*, and probably a slight modification of the generic character will admit it into the latter genus.

ZIZYPHUS, sp.

CARDIOSPERMUM MOLLE HBK.

CARDIOSPERMUM TORTUOSUM Benth. ?

DALEA, sp.

DALEA, sp.

DALEA, sp.

DALEA, sp.

HOSACKIA, sp.—Near *H. rigida*, but annual.

PHASEOLUS FILIFORMIS Benth.

CALLIANDRIA, sp.—Near *C. myriophylla*.

ACACIA, sp.

CASSIA, sp.—Near *C. Lindheimeri*.

COTYLEDON, sp.

CENOTHERA CRASSIFOLIA Greene.

CENOTHERA.—Near *C. speciosa*.

GAURA PARVIFLORA Dougl.

The discovery of a second species of the following genus renders necessary some modification of the generic character. In habit the species are very unlike, the first being a herbaceous annual, with widely separated leaves, the second a shrubby perennial, with small crowded ones.

They agree, however, in two important particulars—the calyx throat is closed by a glandular disk, below which the pistil is adnate to the tube—at least it is not free in the cavity—and the ovary is developed within a leafy branch.

Gongylocarpus Cham. & Schl.

Herbs or shrubs. Leaves alternate. Flowers axillary, solitary. Base of the calyx-tube adnate to the branch, slender, 4-lobed, long-produced, closed at the throat by a fleshy glandular disc; limb 4-lobed. Petals 4, inserted with the stamens below the margin of the annular disc. Stamens 8, the alternate ones shorter. Anthers ovate; ovary 2-3-locular; style filiform; stigma capitate; ovule solitary in the loculus. Fruit woody, enclosed within the branch. Embryo white, filling the seed.

G. RUBRICAULIS Cham. & Schl.

G. FRUTESCENS.—Shrubby, diffusely branched, 1-3 feet high; bark shreddy; leaves alternate, often many-ranked by slow development of the axis, entire, fleshy, oblanceolate, tapering into a short petiole: calyx rose-colored; tube slender, about an inch long; sepals reflexed, linear-lanceolate, about as long as the petals; tips free in the bud: petals paler, obovate-oval, a half-inch or more in length: stamens shorter than the corolla; filaments filiform: ovary irregularly angled, 2-celled: fruit an aggregation of 3-20 ovaries enclosed within a terminal twig at first densely covered with leaves and flowers, which falling leave it marked only by the small protuberances to which the calyx-tubes were attached.

It has not been possible with the material at command to determine with certainty the shape of the embryo; it is more or less curved, somewhat irregularly so, the ovaries altering slightly by mutual pressure. The fruiting twigs look like oblong irregular galls, more or less constricted in parts, and seem to remain on the plant for a considerable time—perhaps more than a year.

This very peculiar genus seems to be nearest to *Jussiaea* and *Ludwigia*, the capsules of which, with alternate bracts upon the peduncle, or even on the ovary, show a distinct approach to it, and the structure of the glandular disc is very similar.

EUCNIDE CORDATA Kell.

MENTZELIA HISPIDA Willd.

SYMPETALEIA AUREA Gray.

Marah minima Kell.

PASSIFLORA FÆTIDA L.

HOUSTONIA ASPERULOIDES Gray.

AGERATUM, sp.

HOFMEISTERIA FASCICULATA (Benth).

FRANSERIA CHENOPODIFOLIA Benth.

FRANSERIA BRYANTII.—Suffrutescent, low and branching, nearly glabrous: leaves bipinnatifid, with linear lobes: ♂ spike short 10–15 flowered: ♀ solitary, 2–3 flowered, usually from the same axil as the ♂ spike: fruiting involucre, as well as the weak inch-long subulate-terete, straight spines, smooth and shining white.

A remarkable species from its very long, white spines, which give it a rather formidable appearance.

HELIOPSIS, sp.

VIGUIERA SUBINCISA? Benth.

BIDENS BIPINNATA Gray.

LEPTOSYNE COREOCARPA Gray.—Of what I take to be this species there are three examples: one, much the larger plant, agrees very well with Dr. Gray's description, to which may be added—akenes strongly scabrous on both surfaces, rays rather large, purple. In the two other plants the rays are apparently white, the akenes smooth on both surfaces, and the border not cleft entirely through. Perhaps this last form may be *L. parthenoides*, or *dissecta*—species which Dr. Gray seems to have suspected to be too near the above.

PERITYLE CALIFORNICA Benth. & var. NUDA Gray.—Rays yellow; leaves varying greatly in size and dissection.

PERITYLE FITCHII Torr.—Rays white, conspicuous.

DYSODIA ANTHEMIDIFOLIA Benth.

POROPHYLLUM.—A shrubby species.

NICOLLETIA EDWARDSII Gray. — Probably this species, though a much more robust plant than the one described, possibly perennial; rays yellow, becoming purplish with age; glands infrequent on the involucre and small on the leaves; scales of the pappus lacerate, the awn arising from a deep notch.

PECTIS MULTISETA Benth.—Pappus of the disk usually awnless, and with merely the rudiment of a crown.

TRIXIS ANGUSTIFOLIA D. C.

MALACOTHRIX XANTI Gray.

ASCLEPIAS SUBULATA Decaisne.

PHACELIA PEDICELLATA Gray.

NAMA HISPIDUM Gray.

HELIOTROPIMUM CURASSAVICUM L.

HELIOTROPIMUM, sp.

HELIOTROPIUM, sp.

KRYNITZKIA, near *K. angustifolia*, Gray.

KRYNITZKIA, sp.

IPOMÆA, sp.

CONVOLVULUS, sp.

SOLANUM ELÆAGNIFOLIUM Cav.

SOLANUM, sp.

PHYSALIS GLABRA Benth.

PHYSALIS, sp.

NICOTIANA, sp.

LYCIUM, sp., near *L. Californicum*.

LYCIUM, sp., near *L. gracilipes*.

Many of our species of *Lycium* seem too closely related; a careful study of intermediate forms in the field would probably much reduce their number.

ANTIRRHINUM CYATHIFERUM Benth.

Dr. Gray, in his Synoptical Flora, casts a doubt upon the distinctness of his *A. chytrospermum*, in the following words:

"*A. cyathiferum* of Lower California appears to differ from the following in having linear-lanceolate sepals of only half the length of the tube of the corolla and a shallower cup to the seeds." The specimens brought by Mr. Bryant from Magdalena Bay show great variation in the comparative length of the sepals and tube of the corolla, as well as in the cups of the seeds, so that it is probable a careful comparison will show them to be too closely related.

No one familiar with *Mohavea viscida* Gray (*Antirrhinum confertiflorum* Benth.) can look at these plants and fail to be struck by their close relationship, especially in habit, capsules and seeds.

STEMODIA DURANTIFOLIA (L.)

CASTILLEIA, sp.

MARTYNIA ALTHEÆFOLIA Benth.

RUELLIA, sp.

RUELLIA, sp.

BELOPERONE CALIFORNICA Benth.

VERBENA, sp.

LIPPIA, sp.

TEUCRIUM GLANDULOSUM Kell.

HYPTIS EMORYI Torr.

STACHYS COCCINEA Jacq.

PLANTAGO PATAGONICA Jacq.

ABRONIA MARITIMA Lam.

ABRONIA GRACILIS Benth.—Probably a form of *A. umbellata*.

MIRABILIS LÆVIS (Benth.) *Oxybaphus lævis* Benth. *M. Californica* Gray.—Mr. Bryant's specimens, brought from Magdalena Bay, are nearly but not quite glabrous, the inequality of the involueral lobes variable and often not greater than is found in our Californian forms.

ALLIONIA INCARNATA L.

PTEROSTEGIA MACROPTERA Benth.

Dr. Parry and Mr. Greene propose a new genus, *Harfordia*, for this species, *P. galioides* Greene, which he considers identical with it; and *P. fruticosa* Greene, from Cedros Island, because, as they state, it "differs from *Pterostegia* in its perennial habit, its axile excentric embryo, and from all known Eriogoneæ in its dioecious flowers."

That the above statements are, to a certain extent, erroneous is shown by these specimens brought from the original locality.

P. galioides, which Dr. Parry reduces to a synonym of *P. macroptera*, is in our herbarium specimens much more unlike that species than is *P. fruticosa*, which seems to differ from it only in its more shrubby and compact habit and shorter nodes. The leaves in Mr. Bryant's specimens are spatulate-obovate, but much broader than in *P. fruticosa*—in Mr. Greene's specimens of *P. galioides* they are very narrow. The flowers, so far as known, as well as the akenes, are identical in all. It is possible that these plants are sometimes dioecious, but *P. macroptera*, at least in our specimens, has male and female flowers from the same axils—the former soon falling. The embryo agrees with the diagnosis of *Pterostegia* in Benth. & Hook. Gen. Pl. (who place it in *Koenigiae*, not in *Eriogoneae*)—"Embryo excentricus, curvus, cotyledonibus suborbiculatis, radícula longiuscula accumbenti-ascendente." As compared with that of *P. drymarioides* it is not quite so much curved, and its cotyledons are oval or oblong instead of suborbicular.

Any distinctions founded upon variations in form or development of the bracts lose all force upon examination of our familiar California species. It seems not to be known that this species (*P. drymarioides*) fruits in two different forms on the same plant, although Hooker and Arnott as long ago as the publication of Bot. Beechy described the flowers as polygamous. The two flowers springing from the axils of opposite leaves are usually unequally developed, one matures in the ordinary variable wing-saccate shape, and the other either aborts and falls, or the bract is folded simply and closely round the akene, the meeting margins erose-denticulate, or, especially in the southern forms, the bract is so little developed that the maturing akene projects one-half its length beyond it.

AMARANTUS PALMERI Watson.

ATRIplex BARCLAYANA Dietr. ?

SUEDA TORREYANA Watson.

EUPHORBIA ERIANTHA Benth.

EUPHORBIA MICROMERIA Boiss.

EUPHORBIA POLYCARPA Benth.

EUPHORBIA, sp.

PHYLLANTHUS, sp.

SIMMONDSIA CALIFORNICA Nutt.

FICUS, sp.

ANEMOPSIS CALIFORNICA Hook.

LORANTHUS, sp.

MUHLENBERGIA DEBILIS Trin.

BOUTELOUA POLYSTACHYA Benth.

BOUTELOUA OLIGOSTACHYA Torr.

CENCHRUS PALMERI Vasey.

II. *Papavereæ of the Pacific Coast.*

As long as species exist and naturalists are found to study them, there will probably be differences of opinion as to their limits, and it is far easier and more gratifying to the personal ambition of a botanist to name and describe forms which shall thenceforth bear his name as an appendage, than to patiently study variations from many localities, and probably end by finding them all run together under older names.

There is, however, a limit to the multiplication of species after the manner which the lamented Engelmann calls "the too common mistake of adopting the characters of a single individual as those of the species," which is soon found in the minute description necessary for the separation of forms, leading continually to the more minute description of other forms which will not exactly agree with any of those already described, a process which very shortly reaches far beyond the sublime. In Esch-

scholtzia, for instance—a very variable member of a variable family which has lately suffered such great amplification—we are already gravely asked to count the number of stamens, and consider the fraction of a line in the width of a torus, or the length of a filament. There are in this genus of such wide distribution, probably fifty more species quite as good as those recently described, and *Platystemon* probably contains nearly as many.

That the flora of California is unusually variable is beginning to be understood. Some of the causes of this variability are well set forth in a preceding paper, and probably amplifications of our well-known genera will henceforth be looked upon with some doubt. The tendency of natural history has usually been in the opposite direction—many species described, often from widely separated localities, and from single or fragmentary specimens, being found, in the course of time, to be too closely connected by intermediate forms, the species are more or less reduced.

That the conclusions drawn by the writer from the following notes may in some cases be erroneous is quite possible. That there may be no doubt as to the facts, sets of the plants noticed will, as far as possible, be distributed to the principal herbaria, especially to those most interested in our flora.

As will be seen by the following tribal arrangement, I have ventured to differ from Dr. Gray's last tentative revision by replacing *Dendromecon* in *Hunnemannia*, where, by its affinities, it seems to belong; and from Bentham & Hooker (though agreeing with Dr. Gray), by placing *Romneya* in *Eupapavereæ*.

The general opinion (with which I fully agree) seems to be that *Hunnemannia* cannot be kept up as a distinct genus, but as it is known to me only by description, it is left for future consideration.

Tribe I. PLATYSTEMONEÆ.—Leaves mainly opposite or

whorled. Flowers trimerous. Stigmatic apices of the carpels distinct, alternate with the placentæ.

1. PLATYSTEMON.

Tribe II. EUPAPAVEREÆ.—Leaves mainly alternate. Flowers rarely trimerous. Carpels completely combined, even the stigmas confluent or radiate from a common center, never more numerous than the placentæ. Capsule ovoid or oblong.

2. CANBYA. Trimerous, and stigmas opposite placentæ.

3. ARCTOMECON. Dimerous and stigmas alternate with the placentæ.

4. ROMNEYA. Trimerous (but pluricarpellary), and stigmas over the septiform placentæ.

5. ARGEMONE. Di- or trimerous. Stigmas over the placentæ. Style short, radiating.

6. PAPAVER. Di- or rarely trimerous. Stigmas over the placentæ and radiating upon the convex or discoid summit of the ovary.

7. MECONOPSIS. Dimerous. Stigmas over the placentæ. Style clavate.

Tribe III. HUNNEMANNIÆ. Leaves alternate. Flowers dimerous, erect in the bud. Stigmas confluent, with 2-merous divergent lobes. Capsules linear, hard, grooved, elastically dehiscent from base to apex along the two placentiferous margins.

8. DENDROMECON. Shrubby. Leaves entire. Seeds carunculate.

Herbaceous. Leaves dissected. Torus excavated. Stigmas more numerous than the placentæ.

9. HUNNEMANNIA. Sepals discrete. Stigma lobes short, ovate.

10. *ESCHSCHOLTZIA*. Sepals coherent. Stigma lobes linear.

Certain field observations made recently appear to me to so materially alter the relations of *Platystigma* and *Platystemon* as to enable them to be satisfactorily placed in the same genus. This is the more desirable, because their resemblance is so great, before the development of the capsule, as to require careful scrutiny to distinguish them.

Platystemon Californicus was observed this year at San Simeon, by the writer, with quantities of dark-brown shining seeds escaping from the apex of a capsule having coherent carpels, which, though folded in the usual manner and lightly coherent, were not torulose, and contained no seeds, the enclosed ovules being entirely undeveloped. By opening and carefully stretching a section of the ovary under the microscope, the folds of the carpels may be opened and the manner of the development of its singular fruit displayed. Each carpel has four nerve-like placenta, those farthest from the margin being enclosed by folding, the two nearest forming part of the wall of the capsule, and their ovules, unless aborted, maturing in its cavity.

P. linearis makes a close approach to this method of fruiting—its deeply sulcate capsule is formed of carpels which fold but do not unite, and the resemblance is still greater when, as often happens, they are increased in number. So far as I know, this form has not attracted the notice of any one, though subsequent examination of herbarium specimens shows that it was collected many years ago at Santa Cruz. Mr. Brandegee brings it also this year from Santa Rosa Island.

Both these species are very variable in size, pubescence, and number and relative size of floral organs. One peculiarity which they share with *Arctomecon* and *Canbya* is the persistency of their petals. It is, however, probably not constant in any of them, certainly not in *Canbya*, and still less in *Platystemon*, though it is very common, and there are speci-

mens in our herbarium where the petals are still firmly adherent to the receptacle from which the ripened carpels have fallen.

P. Oreganus differs from the first two species much more than they from each other, and though quite variable, is much less so than either of them. Its anthers vary from short to long-oval, filaments from filiform to dilated, and leaves from entire to denticulate, in plants growing side by side.

Platystemon Benth.

Platystigma Benth. *Meconella* Nutt.

Annual, herbaceous, branching. Leaves opposite or whorled (the lower alternate), entire or nearly so. Flowers nodding in the bud. Sepals usually 3. Petals 6 or more, often persistent. Filaments dilated. Ovary 1-locular, compound of 3- ∞ carpels with linear or triangular stigmatic apices, which alternate with the nerviform placentæ. Capsules dehiscent from the apex, the valves not separating from the placentæ.

P. CALIFORNICUS Benth.

Hispid to soft villous, with long spreading hairs, or sometimes almost glabrous, erect or prostrate. Leaves linear, sessile or clasping: peduncles long, erect: sepals villous: petals 6-12, cream-color, or the alternate ones yellow, often persistent: ovary sulcate, hispid, villous or sometimes scabrous; carpels 5-40, linear, easily separable, each folded, coherent near its margins, and enclosing two of its four nerviform placentæ, the remaining two forming part of the internal wall of the capsule; ovules many, sometimes developing in the closed carpel and aborting in the cavity of the capsule, sometimes directly the reverse: seeds smooth, dark-brown when found in the capsule, pale if enclosed in the indehiscent carpels, oblong, somewhat incurved along the raphe.

Capsule usually early separating into as many torulose

Pods as there are carpels; in the less common form dehiscing at the apex, and afterward opening along one or more of the placental lines.

P. leiocarpum Fisch. & Mey. is one of the smooth forms, not even separable as a variety.

PLATYSTEMON LINEARIS (Benth.)

Annual, branching, pale-green, more or less villous: leaves linear, sessile or clasping: peduncles erect, elongated: sepals villous: petals 6-12, cream-color, or the alternate ones yellow, often persistent: filaments dilated to near the top; anthers linear: ovary lobed, the compound of 3- ∞ somewhat navicular carpels; placenta several near each margin of the carpel, the edges of which approach but do not unite: stigmas linear-triangular: seeds dark-brown, shining, somewhat incurved along the raphe.—*Platystigma lineare* Benth.

PLATYSTEMON OREGANUS (Benth.)

Annual, branching, glabrous, very slender, with long-jointed dichotomous stems: leaves ovate-spatulate to oblanceolate, or the upper ones linear, entire or denticulate: sepals minutely scabrous near the top: petals usually 6, cream-color: filaments often obliquely dilated near the base: anthers short to long oval: carpels three or more, tipped by narrow stigmas; ovary linear, twisted, the carpels tapering at each end, with one nerviform placenta at each margin: seeds dark-brown, shining, oval or ovate, with prominent raphe.—*Platystigma Californicum* Benth. & Hook. *P. Oregonum* Benth. & Hook. *P. denticulatum* Greene. *Meconella Oregonica* Nutt. *M. Californica* Torr. *M. denticulata* Greene.

CANBYA CANDIDA Parry.—Examination of numerous specimens shows that this plant is even more closely related to *Arctomecon* than had been previously suspected.

The petals differ much in persistence and the capsule is

coriaceous, 3-5, often 4-lobed dehiscent to the middle, not to the base, excepting in age or by violence.

C. aurea Watson, is a slender form, of which, so far as I know, only early plants have been collected, though our specimens show one capsule with mature seeds identical with the ordinary form.

The conditions under which the petals of some of our Papaveraceæ persist, are not yet at all understood, but probably varying heat and moisture will account for the phenomenon more or less.

ROMNEYA COULTERI Harv.

The concave sepals of *Romneya* vary from glabrous to densely spinose. The wing—a prolongation of the upper portion of one margin which is overlapped by the next sepal—is developed in the same manner in *Platystemon*, especially in *P. Californicus* and *P. linearis*. The styles are connate, and the stigmas more or less so. In dehiscence both the valves and placentæ separate from the stout, persistent ribs, which form a spiral frame enclosing the placentæ and the seeds which are for sometime involved in its meshes. The seeds are angular with a prominent raphe, reticulated, and covered with small scurfy tuberculations.

ARGEMONE L.

Our common Californian species, already probably too near *A. Mexicana*, is brought nearer still by the one recently described under the name of *A. corymbosa* Greene. It is a somewhat depauperate form from a very dry region, and only one specimen was collected. The flowers are white, 1-3 inches in diameter, as observed from the car windows. The capsules in the solitary example are 3-4 lobed; rather small; the lobes of the pale, but not blotched leaves are very shallow, and the whole plant is prickly, in the manner of *A. Mexicana*, to which it undoubtedly belongs.

PAPAVER CALIFORNICUM Gray.=*P. Lemmoni* Greene.

This plant, as Dr. Gray notes in his description, very strongly resembles our common *Meconopsis*. In abundant specimens of both, brought from the vicinity of Santa Barbara by Mr. Brandegee, the resemblance is even greater than was supposed, for the flowers prove to be hardly distinguishable in color, and some of the specimens of *Meconopsis* brought from Santa Cruz Island are hairy.

If there were a plant "exactly intermediate in its stigmatic structure" between *P. Californicum* and *Meconopsis heterophylla* which otherwise bear such strong resemblance, all the forms would probably go as *Papaver heterophyllum* (Benth.), but in fact the specimen sent us by Mr. Spence from the original locality has precisely the "conical apiculation" (very common in poppies) which was supposed to justify *P. Lemmoni*. It varies, of course, in height, and the capsule in breadth, in different specimens or on the same plant.

MECONOPSIS HETEROPHYLLA Benth.=*M. crassifolia* Benth. *Papaver heterophyllum* Greene.

There is a structural difference between this plant and *Papaver Californicum*, which appears to have escaped notice. The stout external ribs of the capsule in *Meconopsis* are evidently continuous with the angles of the concave disc. In *Papaver* they are immersed in the capsular walls, and unite with the conical disc beneath the angles.

DENDROMECON RIGIDUM Benth.=*D. Harfordii* Kell. *D. flexile* Greene.

The capsule in dehiscence separates at first from the base, afterward breaking away near the top from the firm, persistent placental ribs. Margins of the leaves membranaceous, usually when mature becoming rough by fissure.

D. flexile is a very luxuriant form; the membranous margin of the leaves usually entire, but not revolute. The thorn-like axillary buds are the same in all the forms.

Eschscholtzia Cham.

Herbaceous. Leaves dissected. Torus excavated. Flowers erect in the bud. Sepals 2, united into a calyptra. Petals 4. Stamens ∞ . Ovary with 2 nerviform placentæ: style short; stigma lobes 4-8. Capsule linear rigid, 30-ribbed, falling from the receptacle and dehiscing from base to apex along the placentiferous margins. Seeds round or oval, reticulate; cotyledons cleft or entire. Juice of the stem colorless, of the root, orange.

ESCHSCHOLTZIA CALIFORNICA Cham.—Annual or perennial, branching or scapose, pale green or glaucous, glabrous, scabrous or scabrous-pilose: stems striate or angular: leaves alternate or the upper ones opposite or whorled, more or less compoundly dissected into oblong or filiform segments: receptacle excavated, the outer margin often more or less horizontally dilated and fleshy; the inner scarious, at first horizontal but becoming erect from pressure of the growing ovary; calyptra ovate to acuminate, often retuse or 2-lobed at the apex, separating at the base and opening by fissure along one side: flowers from broadly campanulate to nearly rotate; petals four, orange, yellow or ochroleucous: stamens ∞ , borne on the petals and deciduous with them; filaments short, anthers linear: ovary many-ovuled, but seeds fewer by abortion: capsules falling from the receptacle and dehiscing elastically from the base upward by two valves, the two nerviform placentæ partially separating from them; seeds round or oval, often apiculate at one or both ends; testa dark brown, reticulated, the surface more or less scabrous, tegmen orange, adherent to the albumen; embryo minute, with cleft or entire cotyledons.—*Chryseis compacta* Lindl.; *C. Californica* Hook. & Arn.; *C. crocea, caespitosa & tenuifolia* T. & G.; *C. Douglasii* Hook. & Arn.; *Omonoia Californica* Raf.; *Eschscholtzia compacta* Walp.; *E. crocea, Douglasii, caespitosa & tenuifolia* Benth.; *E. Mexicana, Austinae, peninsularis, Par-*

ishii, *elegans*, *glauca*, *maritima*, *leptandra*, *tenuisecta*, *glyptosperma*, *Lemmoni* & *rhombipetala* Greene.

Var. *HYPECOIDES* Gray. *E. hypaeoides* Benth. *E. minutiflora* Watson. *E. ramosa* & *E. modesta* Greene.

Var. *TENUIFOLIA*. *E. tenuifolia* Hook.

The large number of forms of *Eschscholtzia* recently described, most of them intermediate between the original species and the already doubtful *E. caespitosa* and *E. minutiflora*, has had the effect of rendering them all untenable, and until the annual forms have been more abundantly collected, not even varieties can be indicated with any certainty. Among the perennial forms there are certainly none yet characterized which are worthy of even varietal rank, all of them and most of the annuals being invalidated by the variable form of our peninsula, a region from which no one has yet had the hardihood to propose a new species.

Eschscholtzia Californica as it grows within the city limits is always perennial, the young plants germinating in Autumn, bloom in the following spring, and thenceforward almost all the time. The branches, as is frequent among our weak coast plants, are prostrate in exposed situations, but more or less erect when sheltered, and dying at the end of the flowering season, are often followed by scapose flowers which spring from among the crown of long-peduncled leaves before the succeeding branches appear. The plant varies from smooth to scabrous; in color from pale-green to very glaucous; the lobes of the leaves from linear to short-oblong; the flowers from 1-2 inches in diameter, from broadly campanulate (never "funnel-form," at least in full expansion) to nearly rotate, from orange to pale yellow or ochroleucous, with or without a deeper orange base; the calyptra, from long-acuminate to short-ovate, usually bilobed at the apex, and opening by one long fissure and two or three shorter ones; the torus rim from $\frac{1}{2}$ -2 lines in width;

the stamens from 12-40 in number, and the seeds from round to oblong-apiculate, with cleft or entire cotyledons.

The roughness of the surface of *Eschscholtzia*, for which I do not know a very appropriate term, is exceedingly variable. It is never really scabrous, for, though uneven to the touch, it is always soft. Its mode of formation is best observed in such forms as *E. maritima*, where the epidermis is raised in small folds over nearly the entire plant, or in our coast form, where it seems to be produced, in part at least, by laceration of the membranous margins. The forms described as "hirsute-scabrous," "hoary-pubescent," etc., have only elongations of the ordinary roughness.

The development of the flower is analogous to that of the rose—the apical point ceasing to elongate, the outer layers of the floral axis rise above it as a wall and are folded over at the summit, the order of succession of the floral organs being apparently from above downward. The portion of the folded top of the receptacle to which the petals and stamens are attached, is at first horizontal or depressed, and usually marked with as many more or less prominent ridges as there are stamens in the inner row. The outer margin of the fold is often developed into a prominent fleshy rim, to which an undue amount of importance has been attached, but in many cases hardly a trace of it can be found, the so-called "outer rim of the torus" in such cases being the line of attachment of the caducous calyptra.

The petals are very frequently uneven, notched, or even lobed, apparently from crumpling in the bud, and very variable in size, shape and color even in the same variety.

The seeds of *Eschscholtzia* are all, so far as I have seen, reticulate, the elevated lines being apparently of the same nature as the papillose-scabrous roughness of the plant. The reticulations and their nature can best be seen in immature seeds; later they are obscured by irregular development, as in var. *tenuifolia*, sometimes in *leptandra* and in our

coast form, where a part of the reticulation is unequally and excessively developed, even—which occurs in no other form—hiding the raphe.

In some of the forms the minute roughness of the seeds, which ordinarily is barely visible with a good glass, is unusually developed, filling the reticulated spaces with an ash-gray scurf. This is very common even in the form about San Francisco, where the same capsule frequently shows us seeds of the ordinary brown color and others wholly or partially scurfy and gray. In the form described as *E. glyptosperma* this scurf, unusually developed, seems to spread not only over the intervals but over the ridges as well.

It was, I believe, Professor Coulter, in the Botanical Gazette of August, 1879, who first called attention to the peculiar variation of the cotyledons of *Eschscholtzia*. It has since, however, in a note appended to the description of *E. tenuisecta*, been announced as a discovery of great importance that those “whose torus lack the spreading outer rim have entire cotyledons, while those which possess that spreading outer rim have them deeply bifid, *i. e.* cleft below the middle into two linear segments.” How little reliance is to be placed upon this character as an aid to classification, may be seen from the fact that in a handful of germinating plants gathered by Mr. Brandegee from a trench by the side of the road near the Marine Hospital, the greater number had bifid cotyledons, many were entire, some were bifid on one side and entire on the other, some bifid on one side and 3-cleft on the other, and one was 3-cleft on one and 4-cleft on the other side. These peculiarities are even more striking in the minute embryo, for there they are cleft nearly to the base and so, as Professor Coulter remarked, apparently often have three, four, five or six separate cotyledons. It will be readily understood that sufficient seeds for proper investigations could not always be spared from herbarium specimens, so that in the notes appended I have often been obliged to draw conclusions from a few,

and in several cases as noted, none have been seen, but our ordinary perennial form and the one described as *E. leptandra* have been more fully studied. In these forms as well as in the other perennial ones, bifid cotyledons are certainly the rule. It may be that the cleft cotyledons are the seed expression of luxuriant growth, for in the smaller annual forms they vary from entire to various degrees of lobing, in apparent accordance with such a theory.

Whether the forms of *Eschscholtzia* are perennial or annual, seems to depend upon the amount of heat and moisture. As a rule, the middle coast, and the northern ones are perennial. Those of the southern coast and of the interior are mostly annual. The island variations have not been sufficiently observed, but are probably dependent upon similar causes. In the foothills of the Sierra Nevada the stoutest of all our perennial forms grows about small streams and in springy places, while the slender annual var. *tenuifolia* is found on the dry ground not far away.

E. glauca matches very well one of the common forms about San Francisco. It is often hardly glaucous at all, and, as Mr. Brandegee observed on Santa Cruz Island, is frequently of a reddish hue throughout.

E. maritima is the most scabrous of all the forms, though the pubescence is short. Its calyptra, in luxuriant cultivation sometimes becomes foliaceous at the tip. The peculiar whiteness of the foliage is partly pruinose, partly the effect of the irregular elevations of the epidermis.

E. leptandra is as strongly perennial as *E. Californica*, of the coast. It is not "strictly erect," is either green or glaucous, and varies much in dissection of foliage. The seeds are either ash-gray or brown, and many of them have strap-shaped reticulations similar to, but shorter than those of *E. tenuifolia*. The author of the species says that it is found in "desert plains near Verdi, in the western part of Nevada," a somewhat peculiar habitat for a perennial form, until it is explained that the locality is in the cañon of the

Truckee River. The cotyledons are cleft nearly to the base.

E. Austineæ differs from the common form in its very slight or obsolete torus rim. Its cotyledons are entire or one cleft and the other entire.

E. tenuisecta I have not seen. From the description, it approaches the annual forms *elegans* and *peninsularis*, and, like them, has cleft cotyledons.

E. Parishii was described from small flowering specimens only.

E. elegans.—The annual form corresponding to *E. Austineæ*. Cotyledons entire or one of them cleft.

E. peninsularis.—Exactly the ordinary form of *E. Californica*, but annual. Cotyledons shortly cleft or merely notched.

E. Mexicana.—The annual representative of the form described as *E. leptandra*. I have not seen mature fruit.

E. rhombipetala.—of which *E. Lemmoni*, judging from the description, is a more elongated-scabrous and less scapose variation—is one of the most peculiar forms and perhaps separable as a variety when better known. It has usually entire broad cotyledons.

E. ramosa has entire or barely notched broad cotyledons. Some specimens from Santa Cruz Island are only a few inches in height, branching from the base; and a straggling form has been collected on San Clemente. It is not "strictly maritime, growing only within reach of the sea spray;" Mr. Brandegee found it in abundance near the summit of Santa Cruz Island.

E. glyptosperma.—The seeds are not really pitted, as may be seen by examination of the immature ones; the reticulations are covered, as well as nearly all of the intervals, by a gray scurf, like that which appears in many of the other forms.

E. modesta.—Examination of Mr. Parish's No. 1951, shows some curious discrepancies between the specimen and the description. The flowers do not nod in the bud, the petals are often entire on the margins, the anthers and filaments of about equal length. The stamens which in the description are said to be definitely 8 "in two rows on opposite sides of the pistil"—whatever that may mean—were found to be ten in the first flower examined, three on the base of two petals, and two on the alternate ones.

E. tenuifolia is the best defined of all the forms, but it has not been enough collected to determine the constancy of its characters. So far, only nearly scapose forms with 2-lobed calyptras and tuberculate-scabrous seeds are known.

III. *Miscellaneous Studies.*

RHAMNUS CROCEA Nutt. *R. ilicifolius* Kell. *R. insularis* Greene.

In the vicinity of San Francisco this plant grows as a small, straggling shrub, with very small leaves. On the slopes of Mt. Diablo and in Lake County it frequently attains a much larger growth. Dr. Kellogg, who described this robust form under the name of *R. ilicifolius*, notes that it is often as much as six inches in diameter, and a wood section brought by the writer from the vicinity of Antioch, which was cut from one of the branches of a small tree, exceeds that measurement. Excepting increased size of trunk and leaves, it differs in no way from the ordinary form.

Var. *PILOSA* Trelease Mss., from the Santa Maria Valley, in the mountains back of San Diego, is the most distinct of the known forms. The leaves are revolute, and all parts of the plant pilose. It is insufficiently known, only fruiting branches having been collected.

R. insulus Kell., must still be considered doubtful, for, though both the specimen and the figure so marked, are

undoubtedly *R. crocea*, they do not agree with each other nor with the description, in which the fruit is said to be "greenish-black," and the leaves "thin, repand-mucronate dentate."

RHAMNUS CALIFORNICA Esch. *R. oleifolius* Hook. *R. tomentellus* Benth. *R. rubra* Greene.

The depauperate form described under the latter name grows at an altitude of from 4000-6000 feet on the eastern slope of the Sierra Nevada, in poor soil composed of disintegrated granite sand. On the western slope, in richer soil, it is a much more robust plant at the same altitude, and descending along the line of the Central Pacific Railroad it merges by almost imperceptible gradations into *R. tomentellus*. The description contains some errors. The author says: "Species allied to the evergreen *R. Californica* of the western part of California, which is of a quite different floral character, its calyx segments being rotate-spreading, its filaments subulate and sufficiently elongated to bear the anthers clear above the petals, which latter are entirely destitute of the hairiness which a good magnifying power reveals in *R. rubra*, so designated partly because it will be an easy and euphonious name, and partly because the outer bark has a red-brown tinge very unlike that of the species with which it will stand in closest juxtaposition." Elsewhere he says that the berry is two-seeded, pyriform, and the seeds narrowed at the base.

Examination of hundreds of growing plants of all the forms shows that so far as the flowers are concerned there is scarcely a perceptible difference. The young stems are red-brown, the old ones gray, quite as much so in our sand-hills as at Truckee. The petals are bifid and cucullate in all the forms never "concealing the anther," no more naked in the coast than in the mountain form. The berries of all the varieties are often 2-seeded, and when so are not depressed-globose; those of *R. rubra* when, as often, 3-seeded, are as much so as in any other form, and the differences of the

seeds are trivial and inconstant. The leaves are deciduous at high altitudes; even our form at the level of the sea loses most of its leaves in midwinter, as I have often had occasion to remark in looking for the cocoons of *Telea ceanothi*.

R. Californica varies greatly in size and habit. It is usually a bush from 4-12 feet high. Immediately along the coast, in unprotected situations, it is apt, like so many of our coast plants, to become prostrate, forming circular patches 6-12 feet in diameter, the stout branches often more or less covered by the soil. In Marin County it often makes a small compact tree, 15-20 feet in height and 25-30 inches in circumference.

All our forms, running together, seem also to run into *R. Purshiana*, but the latter is not sufficiently well known to me, especially in mature fruiting specimens, to allow the formation of a definite opinion on the subject.

Purshia glandulosa Curran.—Fuller material from various localities in California and Nevada has convinced me that Dr. Gray was right in looking upon this as a mere form of *P. tridentata* DC.

HAUYA ARBOREA (Kell.) *Oenothera arborea* Kell. *Hauya Californica* Watson.

The anthers are not aristate and the filaments are deltoid, those opposite the petals much shorter than the others; the style is tortuous near the summit; the wing of the seed triangular-acuminate, longer than the body; and the lower half of the calyx-tube hairy within. The generic character must therefore be modified in some respects.

This plant bears a considerable resemblance to our familiar *Zauschneria*. The habit is very similar, as well as the shape of the calyx-tube, and attachment of the petals. The anthers in Dr. Kellogg's colored drawing are represented yellow, but in more recent specimens they are found to be rose-colored like the petals.

ZAUSCHNERIA CALIFORNICA Presl. · *Z. Mexicana* Presl.
Z. latifolia, *tomentella*, *villosa* & *cana* Greene.

The characters on which these later species were founded are not well borne out by the specimens. Why a plant with a woody perennial base should not be called suffrutescent is hard to understand, and a strictly entire-leaved *Zauschneria* has probably never been collected, certainly not by the author of *Z. cana*, whose own specimens though having lost most of their broader leaves, retain sufficient to show that they are frequently denticulate. The broader leaves of *Z. villosa* are feather-veined, the narrower ones of *Z. latifolia* and *tomentella* are not, and these two forms may be collected from the same root, although the latter is said by the author to have a good seed character—the difference between “clavate-oblong.” and “almost pyriform” The pubescence, size of the flower and length of the filaments vary too much, even in the same plant, to be of any value in classification. Mature seeds are not often collected, either because their season is so late or on account of the ravages made by the larva of a small moth, which inhabits its capsule. The species is very abundant throughout the state, the forms growing in the Sierra Nevada usually having rather broad leaves, either slightly or densely pubescent, and the southern forms, unless in shaded localities, much narrower ones with the leaves of the undeveloped lateral branches fascicled in the axils. The form described as *Z. villosa* grows from Monterey southward, and runs into var. *microphylla* (*Z. cana* Greene), both on the mainland and on the islands.

About San Francisco Bay it is probably most abundant on Angel Island, where it varies extremely in the form of the leaves, pubescence, and size of the flowers. The capsules in some of the plants have a very peculiar look, being more than an inch long and twisted like the bud of a convolvulus.

The flowers of *Zauschneria* are horizontal, and in opening

the two upper petals become more or less erect, the two lower lying in the plane of the calyx-tube, but if from any cause the bud is held erect, the flower opens regularly. The lobes of the calyx-tube are usually erect, sometimes, though rarely, reflexed. The globular base is 8-sulcate with as many ribs arising from the grooves, four of them continuing to the end of the calyx-lobes, and the alternate ones terminating in a series of anastomosing arches at the base of the petals, which therefore have a triangular attachment. The base of the calyx is lined by an adnate disc terminating at the narrowest part of the tube in eight lobes, which are very variable in size and shape, sometimes reduced to an irregular line. The erect longer lobes are attached to the calyx nerves; the alternate shorter ones either reflexed, or erect and pouch-like in front of the petal nerves. The filaments spring from behind the lobes of the disc, and are adnate to the nerves, becoming free near the summit of the tube; those opposite the petals about a line below their insertion. The pollen grains are very large, with rounded angles.

The floral structure here described is very similar to that of *Boisdurvalia*, and still more to certain species of *Epilobium*, especially *E. obcordatum*. Indeed the differences between this plant and *Zauschneria* are so very slight that it is difficult to see upon what grounds they can be generically kept apart.

ŒNOTHERA OVATA.—The perennial root occasionally attains a diameter of 2-3 inches, and the leaves are sometimes used as a salad. In the section *Taraxia*, to which it belongs, the structure of the calyx-tube is very similar to that of *Gongylocarpus*, and throws some light upon the peculiar method of fruit formation in that genus. In *Œ. ovata* and its allies, the pistil is not free in the tube, which is closed at the throat by an adnate disk, from the margin of which the petals and stamens are deciduous, the remainder of the floral organs being completely

persistent unless broken by accident. The so-called calyx-tube in this case is absolutely continuous with the ovary, the placenta bearing seeds at the lower part and abortive ovules above, diminishing upward until they are gradually lost in the walls. It is therefore probably to be considered as an upward prolongation of the ovary, like, but much exceeding that seen in *E. gaurapflora* and several other species.

EUCHARIDIUM BREWERI Gray = *Clarkia Breweri* & *Sarcana* Greene.

The genera of Onagraceæ, as at present accepted, are difficult of definition and often confluent, but *Eucharidium* seems to be quite as good as many of the others. It differs from *Clarkia* in its long filiform calyx-tube, its free, 4-lobed disk, four instead of eight stamens, and its peculiar papillose, scale-margined, shell-like seeds.

Whatever differences of opinion there may be as to the generic validity of *Eucharidium*, there can be none as to the specific value of *Clarkia Sarcana*, the specimen having been compared both with Brewer's original and with more recent specimens from Fresno County, and found to be exactly the same, a conclusion which almost any one taking the trouble to read Dr. Gray's description of *E. Breweri*, Proc. Am. Acad. vi. 532, would probably reach without seeing the specimens.

Clarkia is much more closely related to *Godetia* than to *Eucharidium*, having, in common with the former, 8 stamens, an obconic calyx-tube with adnate disk, and similar seeds. All distinctions founded upon the form of the petals are broken down by such species as *G. biloba*, often with 2-lobed cuneate petals, and *G. epiloboides*, sometimes hardly distinguishable from *Clarkia rhombipetala*.

The appendages in the calyx-tube of many of these species, which I have considered to be the lobed margin of an adnate disk, are often mentioned as scales at each side of the

base of the anthers—they are certainly directly in front of and often adnate to them for some distance.

Godetia micropetula Greene.—Original specimens of this show that the calyx-tips are free in the bud, the seeds in one row in each cell. The author states that it is 2-costate on the alternate angles, and that “in aspect it is so unlike *G. purpurea* as to preclude the supposition of its being a deformed state of that species.” As *G. purpurea* belongs to the subdivision “tips of the calyx not at all free in the bud: sides of the capsule not 2-costate: seeds in 2 rows in each cell”, this is probably true, but perhaps a brief examination will show it to be a little nearer *G. quadrivulnera*.

HELIANTHELLA CALIFORNICA Gray.—Numerous specimens from Howell Mountain, in Napa County, show, in many of the heads, a well-developed pappus identical with that of the somewhat more scabrous form of the high Sierras, described in Bull. Cal. Acad. i. 89, as *H. Nevadaensis* Greene. The description and notes there given furnish a striking example of the difficulties under which the mere closet botanist labors; one accustomed to field studies and able to speak from the vantage-ground of familiar knowledge of the plant as it grows on our western hills and mountains, would hardly have been led into describing the form found in the Coast Range as “monocephalous” with leaves all opposite, and he would have probably known that the stems of the Sierra form, described as “simple, bearing at summit about three short-peduncled heads,” were, in reality, frequently more branched than the other form, and often bore seven or eight heads; that on stems springing from the same crown the leaves were sometimes all alternate, sometimes all opposite, sometimes a mixture of the two; and that the akenes of both, but especially of the coast form, were quite variable in shape.

Mimulus L.

Diplacus Nutt. *Eunanus* Benth. *Mimetanthe* Greene.

The recent attempt to divide *Mimulus* by restoring *Diplacus* and *Eunanus* to generic rank, and instituting a third genus for a single species, was, I think, very properly met by Dr. Gray, who reduced the whole to synonymy. The following notes will probably strengthen his views, though they alter the bounds of, or even render unnecessary some of his sections.

Diplacus, even as a section, rests only on its shrubby habit. Its dehiscence "by the upper suture only, from base to near the apex, the valves spreading into a boat-shaped open pod," which was the principal reason given for its restoration to the rank of a genus, is exactly that of the greater number of the species of *Eunanus*, being caused by the broad basal attachment and posterior (upper) gibbosity common to both.

MIMULUS GLUTINOSUS Wendl. *M. puniceus* Steud.; *Diplacus glutinosus*, *latifolius*, *puniceus*, *longiflorus* & *leptanthus* Nutt.; *D. stellatus* Kell.; *D. arachnoideus* & *parviflorus* Greene.

Dr. Gray, in Sup. to Syn. Flora, recognizes only of all these forms, the red-flowered *M. puniceus*, "until intermediate colors are met with," a condition already fulfilled by Mr. Brandegee, who collected specimens with orange-yellow flowers on Santa Rosa Island.

The pubescence of *Diplacus*, partly simple, partly of branching hairs (found sometimes also in *Eunanus*, as Dr. Gray has noted), varies very much even on different plants of the same form; the lobes of the corolla differ a great deal in size and shape, a thing which happens in *Mimulus* much oftener than has been supposed, and the tubercular enlargement at the apex of the capsule, though common, is inconstant even in the typical form of this vicinity.

D. stellatus Kell., has been described as having very small flowers, entire leaves and a stellate (whence the name) pubescence. The specimen from which the description was drawn was badly dried and its characters obscured, but another brought since from the original locality shows that the leaves are dentate and the flowers of the ordinary size and form. The stellate pubescence is probably derived from some neighboring plant, being loosely involved in the tomentum and having no apparent connection with its host.

D. arachnoideus, in specimens brought by Mr. Brandegee from Santa Cruz Island, is often nearly destitute of the "cobwebby" hairs. The flowers are salmon-colored and of the general form of *latiflorus* and *longifolius*.

D. parviflorus is a mere form of var. *puniceus*.

§ MIMULASTRUM Gray.

This section of only two species is separable from *Eunanus* only by the peculiar corolla. If the capsule of *M. Mohavensis* Lemmon, proves to be as variable as Dr. Gray, Sup. Syn. Flora, 444, notes *M. latifolius* to be, the second species, *M. pictus*, will, as I have always suspected, be but a variety of it. The capsule of the latter is almost exactly that of *M. glutinosus*.

§ CENOË Gray.

If this section be maintained it must be on the form of the corolla alone, the capsular characters being too different. Mature fruiting specimens of *M. tricolor* and *Douglasii* are still too little known to determine their dehiscence with certainty, although from their structure it is probably like *latifolius*.

M. ANGUSTATUS (Greene.) *Eunanus angustatus* Greene—All credit for the discrimination of this species belongs to Dr. Kellogg, who described it under the name *M. Clarkii*,

and until recently the only specimens in our herbarium were those collected by Joseph Clark, of Mendocino County, for whom he named it. His description was read at the meeting of the Academy of June 4, 1877, but as the society published nothing from 1876 to 1884, the manuscript, with a colored drawing showing the flowering plant of the natural size as well as the dissected parts, remained in the herbarium with the specimens. Some curious errors in his drawing and description having been adopted by the author of *M. angustatus*, require correction.—The calyx is somewhat funnellform, the tube, after flowering, contracting above the short ovate capsule; orifice oblique; the upright obtuse teeth about a third as long as the tube. The seeds, like those of *M. tricolor*, are regularly reticulated on the surface. The capsule is 1-2 lines in length, ovate, pointed, only slightly indurated at the anterior and posterior sutures, and very slightly sulcate at the lateral ones. The dehiscence is circumscissile at the largest part near the base, the placenta separating very tardily if at all. I have not yet been able to determine whether they break off at the base or, remaining attached to it, break away from the septiferous sutures. This seems a very anomalous capsule for a *Mimulus*, yet the species is so closely related to *tricolor* that it was for a long time included under it as a variety, and careful examination shows that it is but a modification of the ordinary formation in *Eunanus* as well as in *Diplacus*. It can readily be observed in the latter, the opened capsule soon falling from the base, which retains its portion of the septum.

M. ATROPURPUREUS Kell. (*M. Kelloggii* Curran.) and *M. latifolius* are both dehiscent in the ordinary manner of *Eunanus*—completely by the posterior suture, and the valves so firmly coherent in front that if separated by violence the capsule tears irregularly and not along the suture. The last species, in flowering specimens brought by Walter E.

Bryant, from Guadalupe Island, and by Mr. Brandegee, from Santa Cruz Island, proves not to be so different from the rest of the section as was supposed, the tube of the corolla below the expanded throat being nearly twice the length of the calyx.

§ EUNANUS Gray.

Of the species properly belonging to this section, most of them running too closely together, and probably by ample collections and more study reducible at least by one-half, the following have their capsules in dehiscence separated by the whole length of the posterior suture, remaining coherent by the whole or the greater length of the anterior one—*M. brevipes*, *Bolanderi*, *Torreyi*, *Rattani*, *subsecundus*, *Laynece*, *Bigelovii*, *Parryi*, *Fremonti*, *nanus* and *Austince*.

M. mephiticus and *M. leptaleus*—if correctly identified—open to the base by both sutures, and *M. Whitneyi* is too scantily represented in our herbarium to admit of study.

§ EUMIMULUS Gray, including *Mimuloides* Gray, *Erythranthe* and *Simiolus* Greene.

* *Placentæ* more or less separated at the top, in one species nearly to the base.

M. rubellus (including *Eunanus Breweri*), *Suksdorfii*, *montioides*, *Palmeri* (including *exiguus* & *androsaceus*), *primuloides*, *cardinalis*, *Lewisii*, *Parishii* and *pilosus*.

M. PRIMULOIDES Benth.—This plant is not always scapose, especially at lower altitudes, often having a stem as long as the peduncles with 6–9 pairs of leaves and two or more peduncles springing from different axils. I have not observed it to be viscid or slimy, though growing in damp meadows; its long hairs are dewy in the morning and wet the hands when passed over it.

M. RUBELLUS Gray, needs careful study in the field. In some forms at least, and especially through *montioides*, it approaches *M. bicolor* so closely in the structure of the calyx, as well as in the corolla, that if the separated tips of the placenta are found inconstant, it will be difficult to keep them apart.

M. PARISHII Greene, judging by the roots, is certainly perennial, though quite possibly it blooms also as an annual. The lobes of the corolla are emarginate; the seeds reticulate on the surface, but the coat is certainly not loose.

MIMULUS PILOSUS (Benth.)—*Herpestis pilosa* Benth., Comp. Bot. Magazine, ii. 57 (1836). DC. Prod. x. 394 (1846). *Mimulus exilis* Durand, Pac. R. R. Reports, v. 12, t. 12 (1855). *Mimulus pilosus* Watson, Bot. King 225. *Mimetanthus pilosa* Greene, Bull. Cal. Acad. i. 181.

The characters of this plant are obscured by drying under pressure, on which account it has long been misunderstood. The calyx is ovate-ventricose, much like that of *M. Rattani*, rather deeply 5-sulcate, often weakly angled and nerved, and the placenta are separated three-fourths of their length. The plant shares its "sickening solanaceous odor" with *Mimulus pictus* and at least some forms of *M. Bolanderi*.

* * *Placentae firmly united their whole length.*

It is to be hoped that any future revision of this section of *Mimulus* will include all the known forms, especially the South American and Mexican, most of which are very doubtfully distinct from ours.

M. BICOLOR Hartw., although its placenta in all forms known to me are firmly united to the top, is anomalous in this division, being most closely related to *rubellus*, as noted above.

M. MOSCHATUS Dougl. var. *SESSILIFOLIUS* Gray. *M. inodorus* Greene, who in separating it from the former species

says: "Quite distinct from the true musk plant, being of more than twice the size, scentless, and possibly only annual; certainly never rooting at the joints." Elsewhere he says the seeds are white.

I observed it this year on Howell Mountain, Napa County, strongly musk-scented, rooting at every joint in contact with the damp earth, undoubtedly perennial by a great mass of creeping rootstocks, and its seeds exactly as in the typical form, and similar observations have been recorded by Mr. C. R. Orcutt, of San Diego, and others.

The musky odor of this variety, and perhaps of the type, varies in different plants and at different hours, being apparently very much stronger in the early morning when covered with dew.

Var. LONGIFLORUS Gray. *M. moniliformis* Greene.—Dr. Gray was certainly in error in dividing *moniliformis* and retaining a part of it under that name; for as all the forms, whether glabrous or pubescent, have, at least occasionally, moniliform rootstocks and similar flowers, they will have to go together under the same name, whatever it is decided to be.

M. DENTATUS Nutt. in forms from the Sierra Nevada seems to approach *M. luteus* much more nearly than it does any variety of *M. moschatus*.

M. SCOULERI Hook., is still insufficiently known.

M. LUTEUS L. *M. guttatus* DC. *M. rivularis* & *variegatus* Lodd. *M. Smithii* Lindl. *M. Tilingii* Regel; *M. microphyllus* Benth. *M. Geyeri* Torr. *M. glaucescens*, *Hallii*, *nasutus* & *arvensis* Greene.

Any classification of the forms of *Mimulus luteus* and related species, on the basis of "annual" or "perennial," is not only entirely wrong, but very mischievous, leading directly to the inordinate multiplication of names. It is, at best, feebly perennial by what may be termed successive

growth, no part of the plant, probably, living more than a year, and then only in favorable places, such as living springs or swampy places. All those growing in the fields, on rocks or the banks of soon-drying streams, embracing nine-tenths of all the individuals, are strictly annual, seeding themselves and dying early.

In the matter of rooting at the joints—probably all the forms do so under certain circumstances, the annual ones very slightly, if at all, for obvious reasons; and the rank-growing, upright ones, of course, only from those joints in contact with the ground. Besides this, wherever even the prostrate branches are kept, by a layer of leaves or twigs, or by other plants, from close contact with mud or water, no roots spring from them.

About the coast and the foothills of the Sierra Nevada *Mimulus luteus* is usually glabrous in all its forms, or occasionally somewhat pilose. It is often glaucous, pubescent and somewhat viscid at moderate elevations; more glabrous again in the higher (I am speaking of the middle Sierra Nevada, along the line of the Central Pacific Railroad, and the time being late in September, only of the perennial forms growing in wet places); and passing the summit, again pubescent as the altitude decreases. About Reno, the eastward limit of these field studies, both glabrous and pubescent forms grow together in the irrigating ditches; and notwithstanding previous observation of clammy-pubescent and viscid forms, it was with much astonishment that in one locality the plants were found to be almost as slimy as *M. moschatus*, the secretion, however, confined principally to the peduncles and calyxes. This same form showed in many of its flowers a strap-shaped, sterile filament, adnate to the posterior wall for half or two-thirds of its length, the free portion projecting from the throat of the corolla, and of the same color. Occasionally a perfect fifth stamen occurred.

The flowers of *luteus* are, as every observer has noticed, exceedingly variable in size, with no constant relation to that of the plant. They are equally variable in shape: the lobes plane emarginate or obcordate, the lower one especially having a wide range; the throat usually only partly closed by two longitudinal swellings, is sometimes entirely so by their greater development; by a protrusion of the upper side; or, as was observed in some of the high mountain forms, the closing of the throat is effected by a twisting of the middle lobe of the lower lip, one side of which is often turned up, thus bringing it at right angles against the upper, and obstructing it completely.

The calyx, being less altered by pressure than the fragile corolla, has had much more attention given it, and it must be already apparent that no lasting distinctions can be drawn from its comparative width, degree of inflation, or length of teeth. It is not at all difficult, as has been proved, to select from a field filled with annual forms, an apparently good species founded on the calyx alone; but it is hoped these few notes, by calling attention to the necessity of a truer observation than that induced by the wild rush for new species, will bring from our local botanists a mass of notes and material concerning our variable plants which will tend to discourage such hasty and ill-considered work in the future.

Most of the synonymy given above has been so often discussed that a repetition would be useless here.

M. Hallii Greene.—The type of this species is labeled "Rocky Mountain Flora, Lat. 40, *Mimulus luteus* L., from seeds, Athens, Ill., 1864; E. Hall," and is exactly one of the annual forms of *luteus*, with flowers no smaller than are often found on Californian specimens.

M. Glaucescens Greene.—The only reasons given for the making of this species are that it is glaucous and most of the leaves connate-perfoliate; as this last occurs in most of

the forms—there even being in the herbarium one of the typical specimens of *M. nasutus* Greene, collected by Rev. J. C. Nevin, Los Angeles, 1885, with the same peculiarity—it can hardly serve as sufficient excuse.

M. nasutus & *M. arvensis* Greene, are the extremes of our annual forms, separated only by the shape of the calyx, *M. microphyllus* Benth. being so characterized as to include the intermediate ones.

M. Tilingii Regel.—The “matted, fleshy, amber-colored, subtranslucent root-stocks,” which are supposed to distinguish this from the other forms of *luteus*, are to be found only in plants which have not sufficient soil to hide those usually subterranean members from the direct action of the light.

M. LACINIATUS Gray.—To this species, which is very doubtfully distinct from *M. luteus*, belong *M. Eisneri* Kell., and *M. nudatus* Curran.

The following species seem quite closely related, and probably all of them in suitable locations would be found to root at the joints, in all the prostrate branches.

M. GLABRATUS HBK., or its variety *adscendens*, I have never seen, except in so far as represented by *M. Hallii* Greene, which, as noted above, is undoubtedly *luteus*; but the var. *Jamesii*, or at least Dr. Palmer's No. 62, of 1885, comes quite near *M. floribundus*.

M. ALSINOIDES Dougl. and *M. PEDUNCULARIS* Dougl., especially the first, should be carefully collected for variations. Most of the specimens in herbariums, as in ours, are probably the early, upright and nearly simple ones.

M. INCONSPICUUS Gray, with its varieties *latidens* and *acutidens* (*M. acutidens* Greene), will probably be found to include *M. Pulsiferæ* Gray, also.

M. FLORIBUNDUS Dougl.—The more glabrous form, col-

lected by the writer at Tehachapi, and described under the name of *M. geniculatus* Greene, is bent at the joints in a not always vain effort to produce roots—a peculiarity which is often shared by the typical form.

CASTILLEIA FOLIOLOSA Hook. & Arn.—The relative proportions of galea and tube, which form the principal distinction between this species and *C. lanata* Gray, as well as the length and width of the leaves, are found to be variable. The appressed wool in the latter species is usually branched, though less so, and softer than in the first, and some of our specimens of *lanata* are obviously woody at the base. The species are brought still closer by the form collected on Santa Cruz Island by Mr. E. L. Greene, and later from that place and Santa Rosa Island by T. S. Brandegee, and described under the name of *C. hololeuca* Greene. In the description, the calyx is said to be “deeply cleft on the upper side, merely lobed on the lower;” but singularly enough, the author’s own specimens show them to be about equally cleft before and behind. The leaves, also, are often much wider than stated, and the bracts, according to Mr. Brandegee, who brought fine specimens to prove it, are usually red. The plant, though generally more shrubby than *foliolosa*, is often like it only woody at base.

SPHACELE CALYCINA Benth.—This is, evidently, another of our variable species. Bentham describes the leaves as “irregularly dentate,” and the corolla as “white?”—we find it running from ochroleucous, through various dull shades, to purplish, and the leaves either dentate crenate or entire, with cuneate, sub-hastate or cordate base; the floral sessile, the others wing-petioled. It is often low and depauperate, but in sheltered places away from the immediate coast—as on Mt. Diablo—it makes a strong shrubby growth, three or four feet high.

Var. *GLABELLA* Gray, seems hardly worth the rank, running directly into the ordinary form.

Var. WALLACEI Gray, (*S. fragrans* Greene), differs from the type in being more villous and having more glabrous nutlets, and a less broadly campanulate calyx, with longer and more slender teeth. The corolla is purplish in all the specimens seen; otherwise, like the common form about San Francisco. The leaves are much the same, but the villous pubescence masks the immersed glands, on which the "resinous-viscidty" of the common form depends. It is, of course, impossible to accommodate everyone's taste, but it will be amusing to most Californians to hear our "wood-balm" stigmatized as having an "ill-smelling leaf."

ERIOGONUM LATIFOLIUM Smith. *E. arachnoideum* Esch. *E. nudum* Dougl. *E. oblongifolium*, *auriculatum* & *affine* Benth. *E. grande* & *rubescens* Greene.

The two species *E. latifolium* and *E. nudum*, recognized in the Botany of California, were even then known to approach each other very closely, and observations since made, prove that they can no longer be kept apart. *E. latifolium* was described from the form found only along the immediate coast, and extends but a short distance inland, merging by gradations into *nudum*, which was supposed to differ from it in having fistulous peduncles, glabrous involucre, and smaller and more scattered heads. In collections made during the past two years, all these distinctions are found to fail—*nudum*, from the interior, with small scattered heads, often having pithy "peduncles" and involucre as tomentose, as in *E. latifolium* of the coast.

E. grande Greene (*E. nudum* var. *pauciflorum* Watson), is stated to be "near *E. nudum*, but distinguished by its rotate perianth and villous filaments." The author was probably misled by the somewhat ambiguous wording of Bot. Cal. ii. 26, for in all the length and breadth of our State the writer never saw a specimen of *nudum* which did not have filaments villous at the base, and

the perianth rotate—at least until after flowering it folded itself round the akene. Specimens nearly as large as those described, have been collected at Tehachapi Pass.

E. rubescens Greene, which also has “filaments villous at base,” differs in no way from the ordinary form of *nudum*, with glabrous involucre, and more or less fistulous stems, except in having flowers of a deeper rose-color than usual. It is, however, found in paler and even white forms on the same island, as is shown by Mr. Brandegees specimens, and an almost identical form was found by the writer near the Klamath River, in Siskiyou county, with not “sulphur” but bright yellow flowers.

E. arborescens Greene, and *E. giganteum* Watson, are the luxuriant island forms respectively of *E. fasciculatum* Smith, and *E. cinereum* Benth., differing in no way from some of the mainland forms of these species, except in having wider leaves and a more diffuse inflorescence.

DESCRIPTION OF A NEW SPECIES OF CYPRINODON.

BY C. H. & R. S. EIGENMANN.

The new species of *Cypinodon* described below was collected in a hot spring locally known as "Saratoga Spring," in the south arm of Death Valley, Inyo County, California.

The types are in the collection of the California Academy of Sciences.

***Cypinodon nevadensis* sp.n.**

Types No. 580. 3 specimens, .04-.044 m. W. H. Shafer.

Head $3\frac{1}{4}$ - $3\frac{2}{3}$ ($3\frac{2}{3}$ -4 in total); depth $2\frac{3}{4}$ - $2\frac{2}{3}$ ($2\frac{7}{8}$ - $3\frac{1}{3}$); D. 10-11; A. 11; Lat. 1. 26; tr. 9-10.

Form of *C. variegatus*, the back in front of the dorsal conspicuously broader and less trenchant.

Eye 3 - $3\frac{2}{3}$ in the head, $1\frac{2}{3}$ - $1\frac{1}{2}$ in interorbital.

Exposed portion of the humeral scale not larger than some of the other scales. Intestinal canal little more than twice the entire length. *Origin of dorsal equidistant from base of caudal and middle of orbit or much nearer base of caudal.* Base of dorsal little if any longer than snout and orbit. Highest dorsal ray $1\frac{2}{3}$ -2 in head. Caudal rather broadly rounded $1\frac{1}{2}$ in head. Highest anal ray $1\frac{3}{5}$ -2 in the head. Ventrals very short, inserted in front of the dorsal.

Color in spirits, dark gray with an indistinct darker lateral band, and indistinct lighter vertical streaks in the female. Dorsal in the male almost uniform black; in the female lighter with a blackish spot on its posterior rays. Caudal margined with white, within which is a broader blackish crescentiform band, most conspicuous in the male. Pectorals, ventrals and posterior half of anal, blackish in the male, light gray in the female.

PROCEEDINGS.

OFFICERS FOR 1887.

H. W. HARKNESS, *President.*

H. H. BEHR, *First Vice-President.*

GEORGE HEWSTON, *Second Vice-President.*

HENRY FERRER, *Corresponding Secretary.*

CHARLES G. YALE, *Recording Secretary.*

JOHN DOLBEER, *Treasurer.*

CARLOS TROYER, *Librarian.*

J. G. COOPER, *Director of Museum.*

Trustees :

CHARLES F. CROCKER,

E. L. G. STEELE,

THOMAS P. MADDEN,

S. W. HOLLADAY,

J. M. McDONALD,

D. E. HAYES,

E. J. MOLERA.

January 17, 1887,—STATED MEETING.

The PRESIDENT in the chair.

The following were elected resident members:—

C. Max Richter, Charles H. Hinton, N. W. Spaulding,
William G. Badger.

Walter E. Bryant was proposed for membership.

President Harkness read his inaugural address.

A vote of thanks was presented to all the retiring officers,
as well as to those re-elected, for the services performed by
them in behalf of the Academy.

The following papers were read:—

Botanical Explorations on the Island of Santa Cruz, by Edward Lee Greene.

Certain Changes in the Flora and Fauna of California, which have taken place since 1850, by H. H. Behr.

February 7, 1887.—STATED MEETING.

The PRESIDENT in the chair.

The following were proposed for membership:—

Frank Soule, F. V. Hopkins.

Dr. Behr called attention to the donation by Capt. Lucas of two volumes on Reptiles.

The following papers were read:—

Ocean Currents and their Influence on the Climate of California, by C. M. Richter.

New Species of Fungi, by H. W. Harkness.

Dr. Behr read the following obituary notice of Dr. Isaac Lea, the first honorary member of the Academy.

The eminent scientist Isaac Lea, whom we now are called upon to mourn, was the first honorary member of our society, having been elected to that position on the proposition of L. W. Sloat, one of our founders, as long ago as July 15, 1853.

Born in Wilmington Delaware, of Quaker parents, in 1792, he had reached the advanced age of 94 at the time of his death, retaining his faculties and capacity for work almost to the last.

His long and active life was devoted in great to scientific pursuits, and his attention was early directed to mineralogy, in the study of which he became familiar with fossil mollusks. His studies of the land and fresh water shells with the literature of which his name is indissolubly linked, began in 1825, and continued almost to the time of his death, in December 8th, 1886, and his industry was such that the bibliography of his works published in 1885, as Bulletin No. 23, of the U. S. National Museum, fills 279 pages. A large number of these writings are in our library, either occurring in the proceedings of societies or presented by himself. He was a member of many scientific societies both American and foreign. He presided over the Philadelphia Academy of Sciences for several terms, was President of the American Association for the Advancement of Science, in 1860, and filled

many other positions of honor and trust. His life is one of which scientists of all countries and especially Americans, may well be proud.

The following were announced as having been appointed Publication Committee:—

H. W. Harkness, E. L. Greene, C. G. Yale, George Hewston, J. G. Cooper.

The appointment was announced of the following Curators:—

Botany—M. K. Curran, E. L. Greene.

Ethnology and Osteology—David Wooster.

Mammals and Birds—E. F. Lorquin.

Fishes, Reptiles and Radiates—Rosa Smith, H. F. Lorquin.

Geology and Paleontology—E. S. Clark, John Hewston, Jr.

Mineralogy—Melville Attwood, C. D. Gibbes.

February 21, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Walter E. Bryant was elected a resident member.

Additions to Museum:—

Specimen of magnetic iron ore, by George Davidson.

The following paper was read:—

The power of adaptation of Insects, by H. H. Behr.

President Harkness spoke on the fungoid diseases of the Sycamore.

C. M. Richter read a supplemental paper on Ocean Currents.

March 7, 1887.—STATED MEETING.

The PRESIDENT in the chair.

F. V. Hopkins was elected a resident member.

Carl von Hoffmann was proposed for membership.

Additions to Museum:—

Specimens of tin ore and bar of tin, by Melville Attwood.

Specimens of petrified wood, by R. S. Floyd.

Specimen of Doris, by Joseph Marshall.

The following papers were read:—

The Lichens of this Vicinity, by Mary K. Curran.

The Pacific Coast Alders, by C. C. Parry.

March 21, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Curry W. Tjader was proposed for membership.

Additions to the Museum:—

Specimens of fossil leaves, by John Dolbeer.

Specimen of *Octopus punctatus*, by Alex. La Plant.

Specimens of tin ore and stream tin, by Melville Attwood.

F. L. Clarke lectured on the eruptions of Mauna Loa and Kilanea, exhibiting photographs of the locality, taken before, during and after the eruptions.

The following papers were read by title:—

West Coast Pulmonata; Fossil and Living, by J. G. Cooper.

Occultations of Stars by the Dark Limb of the Moon, by George Davidson.

Continuation of Catalogue of Pacific Coast Fungi, by H. W. Harkness.

President Harkness gave an address on some geological features of Egypt.

The resignation of Charles G. Yale as Recording Secretary, and of Carlos Troyer as Librarian were read; the first accepted and the second laid over.

April 4, 1887.—STATED MEETING.

The PRESIDENT in the chair.

The President announced the death of Dr. Albert Kellogg, the last surviving charter member of the Academy.

Dr. Hewston moved that the reading of the minutes be dispensed with, and that the President appoint a committee of three to draft resolutions and memorial concerning the deceased.

The President appointed E. L. Greene, George Hewston and H. H. Behr.

The meeting was then adjourned out of respect to the memory of the late Dr. Kellogg.

April 18, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Carl von Hoffman was elected a resident member.

The following were proposed for membership:—

Adley H. Cummins, George J. Specht.

Additions to Museum:—

Sixteen specimens of copper ores and country rock, by J. R. Scupham.

Specimens of lava from Mauna Loa, by F. L. Clarke.

Specimens of fossil leaves, by J. D. Hoff.

Vertebra from fossil skeleton found near San Ardo, on Salinas River.

Specimens of *Waldhamia*, from Sydney Harbor, by Prof. Liversedge.

F. L. Clarke gave an address on the recent volcanic eruptions in the Hawaiian Islands.

The following paper was read:—

The Formation, Life and Uses of Sponges, by George Hewston.

The committee on memorial to the late Dr. Kellogg, presented the following resolutions and memorial:—

WHEREAS: Our co-worker in the field of science, DR. ALBERT KELLOGG, whose amiable traits of heart and head won the friendship of all who knew him, has, by that divine and inscrutable Providence which governs all things, been removed from his late sphere of action and consigned to the last resting-place of mortal man, be it

Resolved, That it is with sincere regret that the officers and members of this Academy of Sciences have received the announcement of his death, and we hereby desire to express our sympathy with the relatives and friends of the deceased.

Resolved, That the memorial paper and the resolutions of condolence and respect be spread in full upon the minutes of this Academy.

H. H. BEHR,
GEO. HEWSTON,
EDW. L. GREENE,

Committee.

MEMORIAL.

DR. ALBERT KELLOGG, whose death we are called upon to mourn, was born in Connecticut, in the year 1813, and had thus passed the three score and ten years allotted to man. The early portion of his life was passed in travel from place to place in the Southern and Western States, for the sake of his health, which was very infirm. It was chiefly during these journeys that our departed friend became possessed of that enthusiastic love for the characteristic traits and beauties of a vegetation where study and investigation afterwards, when his health was re established, became the leading objects of his life.

Dr. Kellogg came to California in 1849, settling first in Sacramento, from which place he moved in a few years to this city, his home ever since.

During his travels in the Southwest as well as in his whole subsequent life, he was devoted to botanical studies. His enthusiasm for his favorite object never failed, and he had the happy faculty of arousing a kindred enthusiasm in others. Notwithstanding the many odds our departed friend had to contend with: the absence of botanical literature in a new country,

the want of sympathizing friends following the same line of studies, with whom he could have exchanged opinions on questions too complicated to be settled without the experience and co-operation of other observers, he never lost courage, and his botanical writings, extending over the period from 1853 to 1886, were published in various papers and journals of this coast, but principally in the proceedings of this Society. The plants described by him number over two hundred, and a complete list, carefully sought from all sources, was published, in 1885, in the third of our Bulletins.

He was one of the founders of our Society, and the last one living; no other face was so familiar to our members as his, and his cheerful and amiable character endeared him to all. Of late years he very rarely attended the meetings of the Academy, feeling the weight of advancing years and preferring to study and work at home. He usually spent, however, some portion of nearly every day in the Academy building, devoting his time for several years past to making drawings of trees and shrubs of California—"pretty pictures," as he used to call them in his quaint way.

His guileless simplicity and honesty, as well as his enthusiasm for science, made him beloved by all; in all the relations of life his conduct was beyond praise. Those who knew him in early days remember well his filial devotion to his aged mother, and all who had the pleasure to be in daily intercourse with him, praise, with me, his kindness, his patience, and his forbearance. Peace be to his ashes!

The President announced the death of Frederick H. Jenssen, resident member.

Dr. Behr read the following memorial.

Dr. Frederic Jenssen, was born in the year 1847, on the island of Rugen, and studied natural sciences at the universities of Greifswald and Berlin. His studies were directed chiefly to chemistry and especially to explosive compounds, in which department he became a recognized authority and was for some years so employed in the great tunnel of St. Gothard.

In the year 1880, he emigrated to Peru, hoping to find in the warm and dry climate of its coasts, relief from the laryngeal affection from which he suffered, and to which he finally succumbed. While there he received an invitation to come to California and occupy an honorable and lucrative place in the service of the Giant Powder Company, which position he retained till near the time of his death.

During the whole time of his residence he continued experiments and studies in his specialty, and has at various times contributed to scientific societies valuable observations on the causes of so-called "spontaneous explosions" and similar subjects, till lingering disease put a stop to investigations of the highest practical merit.

Dr. Jenssen was only forty years of age when death interrupted the

studies which would not only have greatly increased our knowledge, but by removing some of the dangers attending the use of explosive substances, have greatly benefited the world in general.

May 2, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Curry W. Tjader was elected a resident member.

The following were proposed for membership:—

S. C. Passavant, David P. Belknap, George J. Ainsworth, James Denman.

Additions to Museum:—

Two pieces of sandstone with fossil leaves, by J. D. Hoff.

The following papers were read:—

Botany of the Santa Cruz Islands, by Edward Lee Greene.

Glass Sponges, by George Hewston.

Desmids of the Pacific Coast, collected by Mrs. Hanson and Miss Haggin, and identified by Francis Wolle.

Additions to Library:—

From correspondents, ...	140
By donation.	29
By purchase.	6

F. L. Clarke gave an explanation of several photographs of drawings by Capt. Cook at the Hawaiian Islands, copies of which were presented to the Academy.

Dr. Hewston announced the death of William Ashburner, resident member, and the following resolution was passed:—

Resolved, That it is with sincere regret that the officers and members of this Academy of Sciences have received the announcement of the death of our member, WILLIAM ASHBURNER, and that we do hereby desire to express our sympathy with the relatives and friends of the deceased.

May 16, 1887.—STATED MEETING.

The PRESIDENT in the chair.

The following were proposed for membership:

Hans C. Behr, L. M. F. Wanzer.

Additions to Museum:—

Five specimens of California woods, by H. S. Durdan.

Additions to Library:—

From correspondents.....	116
By donation.....	11
By purchase.....	2

The following papers were read:—

Ornithological Observations in San Diego County, by W. Otto Emerson; read by Walter E. Bryant.

The Evolution of Figures, by Adley H. Cummins.

Dr. Behr gave an explanation of the parasitic worms infesting the sticklebacks at Lake Merced.

The President announced the death of Dr. W. O. Ayres, late member, and Drs. Gibbons and Stout were appointed a committee to draw up resolutions of condolence and respect.

June 6, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Adley H. Cummins and S. C. Passavant were elected resident members.

The following were proposed for membership:—

George G. Blanchard, Hasbrouck Davis, F. H. Vaslit, Bernard Bienenfeld, Daniel Suter.

Additions to Museum:—

Specimens of iron pyrites, by Hans C. Behr.

Wood excrescence from Guatemala, by Juan J. Rodriguez.

Additions to Library:—

From correspondents.....	154
By donation.....	21
By purchase.....	4

The following paper was read:—

Fungi of the Vine, by H. W. Harkness.

The following resolution, offered by Dr. Hewston, was adopted:—

Resolved, That the President be and is hereby requested to call a special executive meeting of the members of this Academy for the purpose of considering the propriety of authorizing the Board of Trustees to borrow money from the Lick Trust for the purpose of the erection of a building for the Academy and the improvement of the Market Street property.

The following resolutions were presented:—

WHEREAS, The President of this Academy has announced the death of WILLIAM O. AYRES, one of the original and for a period of several years most active members, who, coming to California in the full vigor of manhood, supplemented the arduous and honorable duties of his profession by zeal in exploring the new fields of scientific research which were found along the Pacific Coast, and, being a ripe scholar, possessing analytical powers of mind to an eminent degree, made his work in connection with science a compendium of original research which was received as authority by kindred institutions, and which has stood to this day the tests of rigid criticism—

Resolved, That in the demise of William O. Ayres science has lost a useful and vigorous disciple, and the community a valuable member.

That the sincere sympathies of this Academy are hereby tendered to his family.

That this preamble and resolution be entered on the minutes of the Academy, and that the Secretary be directed to transmit an authenticated copy thereof to his family.

Respectfully submitted,

W. P. GIBBONS.

A. B. STOUT,

Committee.

June 16, 1887.—SPECIAL MEETING.

The PRESIDENT in the chair.

The resolution calling the special meeting was read.

A committee, consisting of Dr. George Hewston, F. Gutzkow and J. R. Scupham, was appointed to draw up a set of resolutions.

The committee reported as follows:—

Resolved, That it is the sense of this meeting that the Market Street property be improved as soon as possible.

Resolved, That the Trustees be requested to borrow the amount of money necessary to accomplish that object from the Lick Trust.

Resolved, That a committee of seven be appointed as a committee of conference with the Board of Trustees to consider ways and means to accomplish the desired object.

GEORGE HEWSTON,
FR. GUTZKOW,
J. R. SCUPHAM,

Committee.

The report of the committee was adopted, and in accordance with the resolutions the following were appointed the committee:—

O. C. Pratt, A. S. Hallidie, George T. Marye, Jr., N. W. Spaulding, A. K. P. Harmon, J. Z. Davis, W. S. Chapman.

June 20, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Hans C. Behr and L. M. F. Wanzer were elected resident members.

The following were proposed for membership:—

B. B. Brewer, William Westhoff.

Additions to Museum:—

Specimen of fossil bone from Jones' Hill, El Dorado Co.

Additions to Library:—

From correspondents.....	51
By donation	10
By purchase.....	2

The following papers were presented:—

Sutroa, a genus of Oligochaetae, by Gustav Eisen.

Californian Manzanitas, by C. C. Parry.

Discovery of the Nest and Eggs of the Evening Grosbeak, by Walter E. Bryant.

The President announced that the next meeting would be held July 18.

July 18, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Hasbrouck Davis and George G. Blanchard were elected resident members.

The following were proposed for membership:—

Robert A. Wilson, James De Fremery.

Bernard Bienenfeld withdrew his application.

Additions to Museum:—

Mineral deposit, by F. H. Atwood.

Two specimens of Rocky Mountain Chipmunk (*Tamias asiaticus quadrivittatus*), by H. G. Parker.

Two specimens of Cicada from Siskiyou Co., by M. K. Curran.

Specimens of Fungi from Southern California, New Mexico and Mexico, by S. M. Tracy.

Three sections of California woods: *Lonicera hispidula*, *Nuttallia cerasiformis* and *Spiraea discolor*, by H. S. Durden.

Two specimens of *Lycoperdon sculptum*, also *Polyporus* from Washington Territory, by G. H. Mastick.

Additions to Library:—

From correspondents.....	88
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By donation.....	14
By purchase.....	4

The following papers were read:—

A Botanical Trip in Siskiyou County, by Mary K. Curran.

A New Subspecies of Petrel from Guadalupe Island, by Walter E. Bryant.

Dr. Behr announced the reception of some nests containing the larvæ of Hymenopterous insects.

August 1, 1887.—STATED MEETING.

The PRESIDENT in the chair.

B. B. Brewer was elected a resident member.

The following were proposed for membership:—

T. H. Hittell, Robert Simson.

Additions to Museum:—

Yellow-cheeked Weasel, by John Barber.

Russet-backed thrush (*Turdus ustulatus*), by S. W. Holaday.

Specimen of Pacific Kittiwake, (*Rissa tridactyla pollicaris*) by E. F. Lorquin.

Block of porous obsidian, or volcanic glass, from the Siskiyou Mountains, by Dr. J. M. Selfridge.

Two sections of *Banksia grandiflora*, by H. S. Durden.

Specimen of feldspar containing soda and tourmaline, by J. H. Barbat.

The following paper was read:—

Unusual Nesting Sites, by Walter E. Bryant.

The Bavispe Earthquake, by F. L. Clarke.

August 15, 1887.—STATED MEETING.

The PRESIDENT in the chair.

James De Fremery was elected a resident member.

Additions to Museum:—

Specimen of selenite from Cholame, San Luis Obispo County, by J. G. Lemmon.

Additions to Library:—

From correspondents.....	133
By donation.....	29
By purchase.....	3

The following papers were read:—

Customs and Religious Observances of the Hawaiians, by Brooks O. Baker.

Geographical Distribution of Insects, by H. H. Behr.

A vote of thanks was passed to Dr. Baker for his valuable paper.

Dr. Hewston made some remarks on the dredging being done in the bay.

September 5, 1887.—STATED MEETING.

The PRESIDENT in the chair.

T. H. Hittell and Robert Simson were elected resident members.

Additions to Museum:—

Brincadores, or jumping seeds, from Sonora, Mexico, by T. R. Bours.

Salt-water eel, barnacles found floating freely on the water, parasite of a sunfish, tapeworm from entrails of sunfish—all found half-way between Tahiti and San Francisco—by Capt. Louis Turner, of the Brig Tahiti.

Specimen of myriapod, by Dr. Behr.

Crawfish from Klamath River, by M. K. Curran.

A vote of thanks was passed to Adley H. Cummins for his donation to the library of a copy of his Dictionary and Grammar of the Friesic Language.

The following papers were read:—

Flora of the Coast Islands of California in Relation to Recent Changes in Physical Geography, by Joseph Le Conte.

Truly Dead Languages, by Adley H. Cummins.

The President announced the death of Professor Spencer F. Baird; and Drs. Joseph Le Conte and H. H. Behr were appointed a committee to draw up resolutions of condolence and respect.

September 19, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Specimen of *Sphenodon punctatum*, by Samuel Macaulay.

Seven specimens of Fish: *Chaetodon reliculatus*; *Balistes undulatus*, *Holocanthus bispinosus*, *Holocentrum diadema*, *Ostracion punctatus*; also, eight specimens Crustacea, three Myriapods, two Scorpions, one Cephalopod, all unidentified. Collected at Tahiti and donated by I. E. Thayer.

Two species of Ergot found near Reno, Nev., one on *Eleocharis*, the other on *Elymus* or wild rye and fresh-water sponges (*Spongilla lacustris*) from Donner Lake, by M. K. Curran.

Additions to Library:—

From correspondents	394
By donation	39
By purchase	5

The following paper was read:—

On Heredity, by M. Nusbaum.

Prof. Joseph LeConte presented the following memorial and resolutions, which were ordered to be entered upon the minutes of the Academy and a copy sent to the family of deceased:

In accordance with the desire of the Academy I have prepared some resolutions commemorative of the death of our fellow member Spencer F. Baird. But before offering them it seems fitting that I should make a few preparatory remarks on his character and work in order especially to show how his whole noble career was foreshadowed in his boyhood.

My acquaintance with Prof. Baird commenced in 1843, when both of us were little more than boys, being each about 20 years of age. I was at that time in New York pursuing medical studies and living with my uncle Maj. LeConte and his son John, the entomologist. Baird was also in New York perfecting his knowledge of ornithology by the use of the large collections, public and private, in that city, and frequently and familiarly visited at my uncle's house. At that time my own special field of scientific work was not yet declared. My mind roamed with equal interest, and therefore superficially over many departments; Baird's on the contrary was already unalterably determined. All the lines of his mental energy converged with intense heat on one focal point—Natural History, and especially ornithology. He had neither pleasure nor recreation in anything else. I remember well his tall, slender, somewhat ungainly form and careless dress, his long and rapid strides, his eager but downward look intent only on the subject in mind, and utterly oblivious of all else. How little—far too little of the boy there was about him.

At that time I saw much of him, and in company with my cousin John we often visited the great Audubon, who then lived about ten miles out of New York on the banks of the Hudson. This place, still called Audubon Park, is now swallowed up by the growing city. I recall with intense pleasure the hours we spent there. The extensive grounds dotted over with large trees and sloping down to the beautiful Hudson—the splendid mansion adorned everywhere with trophies of the huntsman and the ornithologist—but above all the tall commanding figure of the host himself, with his eagle eye and high aquiline nose, and abundant white hair brushed straight back from his forehead and falling on his shoulders. Add to these the stately dignity of his wife, the almost boyish genialty of his sons John and Victor, and the hearty hospitality of all, and it is easy to understand the influence on a young and impressible mind. Is it any wonder that with such associations, aided by an early life in the country and passion for gunning, my first specialty was ornithology? During the years '45 and '46 I made a large collections of birds which I afterwards sent to Baird, then assistant in the Smithsonian, and which are now doubtless among the collections of the National Museum.

Since that time of intimate association I have seen little of Baird. Our lives drifted apart; my own investigations, partly through natural taste, partly through the dominating influence of Agassiz with whom I studied in 1850 and 1851, were turned into other channels. But Baird's never swerved from their original direction—not only the original direction of his work, but the most striking characteristic of his mind remained the same. That characteristic was intense energy directed to one point, and oblivious of

all else. As a necessary result he had an enormous capacity for work; but, on account of the limitation of his tasks, it was work without adequate recreation, and therefore exhausting. First, as a subordinate worker in the Smithsonian Institution; then as Assistant Secretary of the same, then as Secretary; then in addition, as Director of the National Museum; then in addition to all, U. S. Fish Commissioner; in all these, although his capacity for work was so great, he ever worked beyond his capacity. Is it any wonder then that his powerful frame broke down. It is simply impossible that any one man can fill his place and carry on all his work. It will have to be divided among at least three. But even thus divided, it is doubtful if it can be better done.

Of his scientific position it is hardly necessary to speak—it is so well known. There are few men whose loss will be so generally and so keenly felt. This is partly the result of his position as Secretary of Smithsonian Institution, and thus as chief agent of exchanges with scientific institutions all over the world, but mainly to the great value of his strictly scientific work. His chief works are his "Birds of North America"—his "Mammals of North America" and his "Reptiles of North America." Of the first the distinguished English ornithologist Sharpe says: "It is a really wonderful work," and chiefly through its influence, it has come to pass that "there is no country where birds are so thoroughly and scientifically studied as in America."

Such is the man whose death we deplore, and in view of our sad loss, I offer, in behalf of the committee, the following preamble and resolutions:

WHEREAS, It has pleased an allwise Providence to remove from his earthly field of labor our friend and fellow member, Spencer F. Baird; therefore be it

Resolved, That we recognize in his death an incomparable loss to our science and a personal bereavement to ourselves.

Resolved, That the life-work of our brother in the field of Natural Science forms a monument to his memory far more lasting and far more honorable than can be made by human hands.

Resolved, That we deeply feel the affliction which has fallen upon his family, and hereby offer our earnest sympathies.

Resolved, That these resolutions be spread on the minutes of the Academy, and that a copy of them be sent to the widow of the deceased in token of our respect and sympathy.

Dr. Hewston made a short address eulogistic of the deceased.

October 3, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Golden Eagle, by H. G. Parker and son.

Bushy-tailed Wood Rat (*Neotoma cinerea*), by Will S. Bliss.

Pieces of pottery from Mexico, and seven human bones from grave near Bacerac, Mexico, by F. L. Clarke.

Additions to Library:—

From correspondents.....	116
By donation.....	9
By purchase.....	2

The following paper was read:—

Properties of Certain Plants of our Flora, Native and Introduced, by H. H. Behr.

Dr. Behr made some remarks on Hymenopterous insects.

October 17, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Library:—

From correspondents.....	175
By donation.....	16
By purchase.....	4

The following paper was read:—

Protozoa, by George Hewston.

November 7, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Ornaments made of the green elytræ of beetles and feath-

ers of the Toucan; also two prepared human heads, greatly reduced in size but retaining their natural form, and ornaments, all from Indian graves in Ecuador. Donated by the wife of Senator Y. S. Seminario, Guayaquil, Ecuador, through kindness of Dr. Sharkey.

Specimens of flies which gather in great numbers and die on shores of Mono Lake. Collected by Mr. Wheeler. Donated by Dr. Stout.

Mr. Frank Cushing addressed the meeting on life among the Zuni Indians.

A vote of thanks was passed to Mr. Cushing.

November 21, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Two specimens of glacial clay—one from north face Protection Islands, Straits of Fuca; one from Port Townsend Bluff—specimen of chrome ore from Mocho Cañon, 24 miles from Livermore. Collected by Capt. J. S. Lawson.

Specimen of gold-bearing quartz, from Stonewall Mine in San Diego Co. Donated by Mrs. Jas. Stockton.

Two cub bearskins, by J. A. Bauer.

Pieces of pottery from Bavispe, Mexico, by F. L. Clarke.

Arctic whalebone, by J. N. Knowles.

Specimen of Evania, by Carl Precht.

California Partridge (*Callipepla californica*), by J. R. Chalker.

Double Nest of Water Ouzel (*Cinclus mexicanus*), by C. H. Edson.

A special vote of thanks was passed to Dr. McNutt for the donation to the Library of three volumes on "The Revision of the Echini," by Alexander Agassiz.

Additions to Library:—

From correspondents.....	446
By donation.....	37
By purchase.....	3
By exchange.....	1

The following paper was read:—

California Earthquakes, by E. S. Holden.

November 30, 1887.—SPECIAL MEETING.

The PRESIDENT in the chair.

Prof. Frank H. Cushing gave a lecture on the recently discovered ruins of the city of Los Muertos, Arizona.

December 5, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Set of four eggs of the Farallon Cormorant (*Phalacrocorax dilophus albociliatus*) and Fossils from Alameda Co., by W. Otto Emerson.

Fossil Fish from the fossil beds of Wyoming Territory, by John Dolbeer.

Additions to Library:—

From correspondents.....	89
By donation.....	2
By purchase.....	2

The following papers were read:—

Unusual Nesting Sites, by Walter E. Bryant.

The Problem of Light, by George C. Edwards.

December 19, 1887.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Specimen of Tufted Puffin, *Lunda cirrhata*, with three sets of eggs of same, by W. Otto Emerson.

Additions to Library:—

From correspondents.....	139
By donation.....	4

The following paper was read:—

Birds and Eggs from the Farallon Islands, by Walter E. Bryant.

The following nominations for officers for the ensuing year were made:—

President—H. W. Harkness.

First Vice-President—H. H. Behr.

Second Vice-President—George Hewston.

Corresponding Secretary—Henry Ferrer.

Recording Secretary—Wm. F. Smith.

Treasurer—I. E. Thayer.

Librarian—Carlos Troyer.

Director of Museum—J. G. Cooper.

Trustees—C. F. Crocker, E. J. Molera, J. Z. Davis, George C. Perkins, E. L. G. Steele, D. E. Hayes, S. W. Holladay.

January 3, 1888.—ANNUAL MEETING.

The PRESIDENT in the chair.

The annual reports of the President, Board of Trustees, Treasurer, Corresponding Secretary, Recording Secretary, Librarian, Director of Museum, Curator of Botany and Cu-

rator of Mammals and Birds, were presented and ordered received and placed on file.

The annual election resulted in the choice of the following officers:

H. W. HARKNESS, *President*.
 H. H. BEHR, *First Vice-President*.
 GEO. HEWSTON, *Second Vice-President*.
 HENRY FERRER, *Corresponding Secretary*.
 WM. F. SMITH, *Recording Secretary*.
 I. E. THAYER, *Treasurer*.
 CARLOS TROYER, *Librarian*.
 J. G. COOPER, *Director of Museum*.

Trustees.

CHARLES F. CROCKER,	D. E. HAYES,
S. W. HOLLADAY,	GEORGE C. PERKINS,
J. Z. DAVIS,	E. J. MOLERA,
E. L. G. STEELE.	

John LeConte and Joseph LeConte were elected life members.

The following were elected honorary members:—

Alexander Agassiz, Joseph Leidy, S. P. Langley, G. Brown Goode, Francis A. Walker, A. E. Verrill, W. K. Brooks, Mrs. E. B. Crocker, E. D. Cope, A. S. Packard, C. V. Riley, George H. Horn, Clarence Dutton, Elliot Cones, Charles B. Cory, Alphonse de Candolle, H. B. Medlicott, James Hector, W. G. Farlow, E. T. Cresson, Joseph Lovering, Francois Crepin, Maurice Chaper, Theodore Lefevre, E. A. Regel, M. de Saussure, D. C. Danielssen, G. O. Sars, Ernest S. C. Cosson.

REPORT OF THE PRESIDENT.

During the year just past the attendance at the meetings has been very large, the attention of the public having been unusually attracted to the Society, and it has had to endure

a large amount of both friendly and unfriendly criticism, which, however unpleasant at the time, will probably be of more or less benefit in the end. It is not always a misfortune for individuals or associations to learn in just what light they appear to others.

The papers read at the bi-monthly meetings have, many of them, been of great interest, as have been some of the informal lectures—notably those of Frank H. Cushing, the well-known ethnographical explorer of Zuni.

The present membership of the Academy is two hundred and sixty-nine. We have during the year lost twenty-eight members, and admitted fourteen. Four members have during the year been removed from us by death.

Dr. Albert Kellogg, the latest survivor of the founders of the Academy, whose presence was familiar to you all, died at the end of February of this year, full of years and good works. His ardent love of nature and child-like simplicity endeared him to all who knew him, and though we shall see his kindly face no more, he will not soon be forgotten.

Dr. Friedrich Jønsen, a young man of great promise, was taken from us in March, 1887. In the department of chemistry, to which he had devoted himself, he had already obtained eminence, but with a brilliant future spread before him the fell ravager, consumption, claimed its victim.

William Ashburner, a well-known geologist, who at one time was a member of our Board of Trustees, died in mid-summer. At the time of his death he was Regent of the State University, and one of the Trustees of the Leland Stanford, Jr., University. His death, after a brief illness, was entirely unexpected, and his life cut short in his prime at the period of his greatest usefulness.

Captain Edward F. Northam, who had maintained his connection with the Society for fifteen years, died in the month of November. Although not devoted to any branch of science, he always manifested a kindly interest in the affairs of the Society.

Among our honorary members death has not been idle. Our losses during the year include Spencer F. Baird, the well-known Secretary of the Smithsonian Institution, to whose scientific labors and administrative talents that organization owes much of present usefulness; Isaac Lea, the eminent conchologist, whose name is a familiar sound wherever shells are studied, and F. V. Hayden, best known through his scientific labors in connection with the U. S. Geological Survey.

The administration of the affairs of the Academy, for reasons of which the members are cognizant, has been attended with much more difficulty than usual. Especially has this been the case with the Board of Trustees, composed largely of new members, who were obliged, as a preliminary to active work, to laboriously familiarize themselves with its affairs, many of them of a complicated nature. This having now been effected, we confidently expect soon to begin the improvement of our Market street property, and furnish ourselves, at the earliest possible date, with suitable quarters.

The affairs of the Academy have been conducted with such care and economy that, although it is believed its internal management has been greatly improved, it has not been found necessary to borrow money for running expenses.

REPORT OF THE CORRESPONDING SECRETARY.

During the past year over two hundred letters have been written to members, principally inquiries as to what publications had been furnished to them. I regret to say that the members who were not regular attendants had received little or no publications whatever. To them publications due have been supplied wherever possible, excepting in the case of Vols. I, II, III or IV of our proceedings, which are now entirely out of print.

Three hundred and seven letters have been written to foreign correspondents, almost all of them concerning the library.

Ninety-three letters have been received from members, and three hundred and forty-nine from correspondents; also, from the latter, over a thousand receipts in letter form, which receipts have been formerly numbered and classified as letters.

Bulletins six, seven and eight have been distributed to members and correspondents; to the latter, through the medium of the Smithsonian Institution. Our exchange list, excluding members — life, resident, honorary, etc.—is now between five and six hundred, and the labor involved is very considerable.

REPORT OF RECORDING SECRETARY.

Notices of each regular meeting have been sent to members, as well as notices of all called meetings.

Number of regular meetings, 23 — the one falling on 4th of July, being a legal holiday, omitted.

Number of called meetings, 2 — one being an executive meeting, to take action concerning the improvement of the Market-street property; the second, a lecture by Frank H. Cushing, on the ruins of Los Muertos.

The publications of the year, from this Academy, comprise three Bulletins—the last, No. 8, completing the second volume. It has been determined to return to the earlier form of publication, and the first part of “Proceedings,” 2d series, Vol. 1, is now being printed; Vol. 7 of the first series being completed by title page and index.

Added to membership during year.....	14
Members lost by death.....	4
Members resigned, etc.....	24
Total present membership.....	269

REPORT OF THE TREASURER.

Balance in bank January 3d, 1887.....\$ 2,736 98

RECEIPTS DURING THE YEAR.

Life members.....	\$ 100 00
Resident members.....	1,524 00
Crocker Fund.....	1,200 00
Rebate from O. Livermore.....	27 48
Rebate from Thos. L. Casey	12 50
Rent Market Street Property.....	5,496 88
Trustees paid in	5 60

Total..	\$11,103 44
Expenditures	9,256 22
Balance on hand.....	\$ 1,847 22

EXPENDITURES.

Crocker Fund.....	\$1,000 00
Ten per cent. commission on dues received by the Officers of Election, Jan. 3, 1887, paid to Fred. Brooks.....	27 60
Salary of W. G. W. Harford, one-half month, Jan- uary, 1887.....	41 66
Salary of William Churchill, one-half month, Jan- uary, 1887	20 00
C. G. Yale, services.....	45 00
Salary of Janitor C. D. Haines	454 00
Salary of Assistant Librarian F. H. Vaslit.....	410 00
Rent	1,800 00
Contingent Fund.....	374 76
Bills from previous year.....	297 13
Interest on Lick loan	275 00
Taxes	2,766 76
Publication	1,266 56
Petty expenses (see vouchers).....	478 25
Total.....	\$9,256 22

SUMMARY—GENERAL FUND.

Balance on hand January 3d, 1887.....	\$2,175 96
Receipts as above.....	7,166 46
	\$9,342 42
Disbursements.....	8,256 22
Balance on hand	\$1,086 20

CROCKER FUND.

Balance January 3d, 1887	\$ 561 02
Receipts during the year	1,200 00
	\$1,761 02
Disbursements....	1,000 00
Balance on hand.....	\$ 761 02

REPORT OF THE LIBRARIAN.

The 35th Annual Report of the Librarian, showing the condition, accession and progress of the library of the California Academy of Sciences, is respectfully submitted:

The increase of scientific literature, which enriches and constantly augments the collection of this society, is mainly obtained by exchange with foreign and home societies; also, from private donations and by purchase.

The total number of publications received during the past year number 2,825, viz:

From correspondents.....	2,416
From individual donations.....	356
By purchase.....	53
Number of volumes completed.....	700

Among the more prominent accessions may be mentioned: 85 Vols. of the 2d Geological Survey of Pennsylvania, including six magnificent large-sized atlases, containing together several hundred maps.

Special mention, also, is deserved the donation of Dr. W. F. McNutt, of this city, who presented to our library the three Vols. of Prof. Alex. Agassiz's "Revision of the Echini"—a work of rare value which is very difficult to procure, even at its present price of \$60.

There are now being bound, and nearly ready for delivery from the bindery, 312 volumes.

The importance attached to the library may be measured by the almost exclusive correspondence being carried on with other societies concerning our publications, and the completing of broken sets of proceedings, etc.

The card cataloguing by authors and subjects has been steadily prosecuted, but it was found necessary at the beginning of the year, before resuming the work, to determine accurately the amount of cards written by Mr. Churchill, who was employed the year previous in doing this kind of work. The Council appointed its own members as a Committee of the Whole to carefully count the cards. The result proved that precisely 52,685 were written, as against 125,000 reported by Mr. Churchill at the last annual election. Unfortunately, however, the greater portion of these were, upon examination, found to be unclassified; and in order to render them available, a great deal of labor and time was required—in fact, it takes nearly as much time to classify a card as to write it.

The book catalogue of our library, completed to date, is to be published in our forthcoming volume of proceedings. This, it is believed, will prove of very great utility to our members and to scientific students, besides furnishing data by which foreign societies can estimate its value and importance.

REPORT OF DIRECTOR OF MUSEUM.

In most of the departments the work performed by the the curators has been simply the care and preservation of their respective collections. The additions to the museum, not included in the appended reports, are the following:

Reptiles	1
Fishes	8
Indian Relics	4
Fossils	23
Minerals	38
Insects	7
Various Invertebrates	22

REPORT UPON THE DEPARTMENTS OF MAMMALS AND BIRDS.

BY WALTER E. BRYANT, CURATOR.

During the past year the number of accessions to the collections has not been large, owing mainly to the lack of duplicates for exchange, and from the failure of persons having specimens to remember the museum, under the mistaken impression that the common forms were not desirable. It is expected that increased activity in this department through the coming year will so bring it before the notice of the public that much valuable material will be received.

Directions for the proper curing of specimens and their preparation for shipment will soon be issued by the curator and sent to parties willing to assist in collecting in these branches of natural history.

Upon assuming his office the curator made a thorough investigation of all the specimens contained in these departments, and found them to be in excellent condition, due to the attention previously given them by his collaborator, E. F. Lorquin.

Five museum cans of the most approved pattern, such as are in use in Eastern museums, have been made to order for the reception of the smaller specimens of mammals and birds, which have been transferred to them. Additional cases are much needed; also chests for the larger skins, which are now deposited temporarily in boxes or wrapped in heavy paper with a quantity of insecticide.

With the assistance of the janitor, the large case of seals

has been cleaned and repapered and the specimens renovated. The Crocker collection of mammals has also been renovated, the case cleaned and rendered dust and insect-proof by the use of rubber packing. Minor matters of repair have been attended to as their need required.

A standard form of label for the collection of skins has been adopted, as it was found to more perfectly meet the requirements of these departments than some of those previously in use. Three sizes of this label are needed. They will be attached to specimens, which will be systematically numbered and catalogued.

The field work covered by the curator has consisted (since April) of collecting trips to Carson City, Nev., and vicinity; various points at Lake Tahoe and Washoe Lake, Nev.; Garden Valley, El Dorado Co.; Summit, Placer Co.; San Diego; San Vicente Valley, San Diego Co.; including brief excursions to places near San Francisco. At all of these localities specimens were collected, many of which were new to the museum.

Copious notes pertaining to the life histories of mammals and birds of this Coast have been recorded, and will be made available for future papers.

A collection of the stomachs and items pertaining to the food habits of the species met with has been made.

The number of original papers prepared for publication consists of six titles.

The indoor work of study and investigation has been carried on under considerable difficulty, owing to the cramped accommodations and unwarmed state of the curator's room and the lack of a small reference library close at hand.

To many members of the Academy, and others who have given assistance and encouragement in the building up of these departments, thanks are cordially extended.

The accessions for the year are classified as follows:

Barber, John, San Rafael, Cal.: 1 specimen of *Putorius* in flesh from San Rafael.

Bauer, J. A., San Francisco, Cal.: 2 pelts of cub bears from Klamath Co., Cal.

Bliss, Will S., Carson City, Nev.: 1 specimen of *Neotoma cinerea* in flesh from El Dorado Co., Cal.

Chalker, J. R., San Francisco, Cal.: 1 mounted specimen each of *Callipepla californica* and *Erismatura rubida* from Watsonville, Cal.

Edson, C. H., Beswick, Cal.: A double nest of *Cinclus mexicanus* from Humboldt Co., Cal.

Emerson, W. Otto, Haywards, Cal.: 1 skin of adult ♂ *Lunda cirrhata*; 3 sets of one egg in each of *L. cirrhata*, and 1 set of four eggs of *Phalacrocorax dilophus albociliatus* from South Farallon Island.

Heaton, T. L., Oakland, Cal.: 1 specimen of *Hesperomys* in flesh from San Leandro, Cal.

Holladay, S. W., San Francisco, Cal.: 1 specimen of *Turdus ustulatus* in flesh from Sunol, Cal.

Lorquin, E. F., San Francisco, Cal.: 1 skin of *Rissa tri-dactyla pollicaris* from San Francisco Bay. (Donated.)

1 skin of *Stercorarius pomarinus*, and 1 mounted specimen of *Puffinus griseus* from San Francisco, Cal. (Purchased.)

Parker, H. G., Carson City, Nev.: 2 skins (with skulls) of *Tamias asiaticus quadrivittatus*, ♂ and ♀, from Carson City, Nev.

Parker, H. G. and son, Carson City, Nev.: 1 specimen of *Aquila chrysaetos*, alive, from Carson City, Nev.

REPORT UPON THE DEPARTMENT OF BOTANY.

MARY K. CURRAN, CURATOR.

The work of the herbarium has been much retarded this year from many causes, most of them sufficiently well known to the Society. The plants received during the year have not yet been incorporated into the herbarium, but it is hoped that it will be possible to do so during the present month. The entire herbarium having recently been poisoned to protect it from the ravages of a small beetle with

which it was infected, all plants added to it have to go through a similar process.

The following additions have been received during the year:

<i>Walter E. Bryant</i>	500 specimens.
<i>Miss M. M. Miles</i> ..	100 “
<i>Curator</i>	800 “
<i>Various sources</i>	150 “

REPORT OF THE BOARD OF TRUSTEES.

BY E. L. G. STEELE, PRESIDENT.

At the first meeting of said Trustees, Thomas P. Madden was chosen President of the Board, and Mr. E. J. Molera Secretary *pro tem*.

Mr. Madden declining to serve, on the 7th February, George C. Perkins was elected Trustee in his place.

The Board completed its organization by the election of E. L. G. Steele, President, and S. W. Holladay, President *pro tem*., and the appointment of a Prudential Committee of Messrs. Holladay, McDonald and Molera, and a Financial Committee, consisting of Messrs. Crocker, Perkins and Hayes.

There has been but little important business transacted by the Trustees during the year, although a great deal of time and personal attention has been given by the Board in weighing and considering the proper means, and in preparing for the building to be placed upon the Market-street property of the Society. A most satisfactory letter has been received from the Secretary of the Lick Trust, giving us the amount which they estimate will eventually be available for the uses of this Society, viz: about \$350,000.

In the Board of Supervisors of this city, there has been some discussion, and resolutions have been offered, to the effect that the lot on First avenue, which had been, since

1868, reserved for the uses of this Society, should be utilized for school purposes.

Upon the attention of this Board being called to this matter, the Prudential Committee undertook a careful investigation of our rights, and found that, in their opinion, our title was a good one, lacking the formality of a formal official acceptance of the lot by this Society—which paper was transmitted on the 24th December to the Mayor and Board of Supervisors.

The report of the Prudential Committee to this Board is appended hereto, and will give you more in detail the particulars of their investigations and actions regarding this property.

This Board has endeavored, during its term of office, to second the efforts of the Council in authorizing the issuance of several valuable bulletins, and in the purchase of matter which they believed would keep alive the interest of its working members, and indicate to the scientific world at large that this Society was earnestly at work, and keeping pace with kindred societies in the development of scientific research.

The Trustees have not been compelled to borrow any money during the year. The income of the Society, together with the funds on hand when this Board assumed office, have been sufficient for all its expenses, and we have at present a balance in the Bank of California of General Fund, \$1,086.20, and Crocker Fund, \$761.02—together, \$1,847.22.

For particulars of receipts and disbursements, we refer you to the vouchers on file, and to the Treasurer's Report, hereto attached.

The Trustees have deemed it expedient, for the proper protection of the deeds and bonds belonging to this Society, to rent for its use a box in the Safe Deposit Company, at an expense of \$15 per year.

The personal property and real estate of the Society, with

the exception of some additions to the library, remain as at date of last annual report.

The Trustees regret that they have not yet been in a position to put in execution a proper plan for the better preservation and care of its large museum; the difficulties have been grave, and in view of many legal doubts, they have felt themselves warranted in proceeding with care before incurring serious liability.

Through the careful investigations we have made of the legal conditions surrounding our property and bequests, we are gradually eliminating doubtful questions, and shall feel that we have left to our successors in office much valuable information, which will simplify their labors materially.

REPORT OF THE PRUDENTIAL COMMITTEE.

The Prudential Committee of the Board of Trustees, in view of the importance of the affairs intrusted to them by the By-Laws of this Academy, considers it to be its duty to give a resumé and account of its acts during its term of office to this Board of Trustees.

Two very important matters have been the main object of its care, viz.: 1st. The improvement of the valuable lot on Market street, given by the late James Lick to this Academy, with the view to provide a home for the Academy and at the same time derive a permanent revenue; 2d. The settlement of all differences between this Academy and the Board of Supervisors in regard to the lot on First Avenue near Point Lobos Avenue.

Soon after the organization of this committee its chairman gave notice and afterwards moved that this Academy proceed at once to build a suitable building on its lot on Market street. The Council of this Academy soon after transmitted to this Board of Trustees a communication to the same effect, and, finally, the Academy at large, at a special meeting, called for the purpose, passed resolutions in favor of erecting, as soon as possible, a proper building

on the Market street lot, and appointed a committee to confer with your honorable body.

In view of all these facts your Prudential Committee gave attention to this matter, and has the honor to report the following progress :

An abstract of title and a copy of the proceedings of the Lick Trust were obtained, and, upon careful examination thereof by the chairman of this committee, it was found that the title of the Academy to the Market street lot is valid and absolute; the right to the one-half residue of the Lick Estate is also considered to be of the same nature.

In order to ascertain the amount and availability of the residue of the Lick Estate, this committee addressed to the Trustees of said estate a communication asking all possible information in that respect. The Lick Trustees, through their secretary, informed your committee that by the end of 1887 the Academy's share to the Lick Estate residue would amount to nearly \$350,000.

This committee considers of great importance the entering into an agreement between this Academy and the Society of California Pioneers, by means of which this Academy may acquire the right to use the court, belonging to said Society and Miss Cora J. Flood, for the purposes of getting access, light and ventilation to the rear portion of any structure this Academy may erect on the Market street lot. From several interviews with representatives of both parties your committee feels confident that a favorable agreement might be concluded.

The party wall between this Academy's lot on Market street and Miss Flood's building has been finished, and the Academy's share of the expense is nearly \$5,000, payable at the time the Academy makes use of it.

Another important matter that has engaged the attention of your committee, arising during the year just expired, is an attempt by the Board of Education to divert the dedication of the Academy of Science lot on First Avenue,

near Point Lobos Avenue, measuring $240 \times 157\frac{1}{2}$ feet, and convert it into a school lot. As soon as this matter was brought before the Board of Supervisors the chairman of this committee and Trustee Molera appeared before the Board of Supervisors, remonstrated against the intended diversion, and gave notice that this Academy would resist, by all lawful means, any attempt to deprive it of the use of said lot.

On examination of the records of the Board of Supervisors, your committee finds that said lot was duly set apart and dedicated to the uses of this Academy by the Board of Supervisors of this city and county, which action was ratified by an act of the Legislature of this State. The formal acceptance of said dedication by this Academy was made by this Board of Trustees, and now this committee considers the right to said lot to be in this Society.

Your committee takes this opportunity to express the opinion that in view of the general desire of the members of the Academy of Sciences to have a building for the use of the Academy, and as a source of revenue, on the lot on Market street, the incoming Board of Trustees should proceed at once to take the necessary steps to build on the Market street lot, and we hope to see the foundations laid during the present year.

S. W. HOLLADAY,
E. J. MOLERA.

January 16, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Nine specimens of wood: *Cephalanthus occidentalis*, *Betula occidentalis*, *Eriodictyon glutinosum*, *Spiraea discolor*, *Rhamnus Purshiana*, *Nuttallia cerasiformis*, *Lonicera hispidula*, by H. S. Durden.

The following paper was read:—

The Names of Colors in Ancient Languages, by H. H. Behr.

February 6, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Gilbert Palache was proposed for life membership.

Additions to Museum:—

Six boxes of insects, largely Arachnides, most of them mounted on microscopic slides, presented by H. W. Turner of the U. S. Geological Survey.

Two decades of Hepaticæ Americanæ, by Lucien M. Underwood.

A collection of one thousand species of Plants, by Prof. R. A. Philippi, an honorary member of the Academy, residing in Santiago, Chile. This valuable addition to the herbarium is in exchange for a package sent by M. K. Curran, curator of botany.

The following paper was read:—

A New Method of Quantitive Determination of Bromine in Sea Water, by F. Gutzkow.

The following resolution, offered by Jos. D. Redding, was adopted:

WHEREAS, The attention of the Government of the United States has been called to the advisability of establishing a National Park in the vicinity of Mount Shasta, Siskiyou County, California, for the purpose of preserving the natural beauties, the game and the aspect of the country in their native condition; and

WHEREAS, The McCloud River has its rise at the base of Mount Shasta, and extends some fifty miles in a southerly direction and empties into the Pitt, which empties into the Sacramento River; and

WHEREAS, The said McCloud River is the natural spawning-ground of the Pacific Coast Salmon in California; and

WHEREAS, The said McCloud River will be in time polluted by the incursion of tourists and the establishment of saw-mills, etc., around its banks; now, therefore, be it

Resolved, By the Academy of Sciences of San Francisco, That it is the earnest wish of said Society that there shall be a National Park established around the base of Mount Shasta for the first-named purposes, and furthermore, that said National Park shall extend in territory so as to include the McCloud River, so as to hold the same inviolable forever for the purposes of pisciculture and fish industries of our State; and furthermore, that this Society will cause a copy of this resolution to be forwarded to the Congressmen representing California before a bill is introduced or passed establishing said Park.

The President announced the death of Dr. Asa Gray, the eminent botanist, and George Hewston, H. H. Behr and M. K. Curran were appointed to draw up resolutions of respect.

February 20, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Four specimens California Jay, (*Aphelocoma californica*), three specimens Blue-fronted Jay, (*Cyanocitta stelleri frontalis*), two specimens California Shrike, (*Lanius ludovicianus gambeli*), one Californian Thrasher (*Harporhynchus redivivus*), by L. Belding.

Five petrified shark's teeth from Delaware River, by James Wethered.

Thirty volcanic specimens from the great crater of Kilauea, Hawaiian Islands, by Dr. Ferrer.

Dinematicthys marginatus, by C. F. Glass.

Cast of fossil jaw of *Palæotherium titanotherum*, by Dr. Hewston.

Seventy species of plants, by C. F. Sonne.

Additions to Library:—

From correspondents.	183
By donation	11
By purchase	7

The following paper was read:—

On the Races of Man and their Limitations, by Adley H. Cummins.

The committee appointed to draw up resolutions on the death of Prof. Asa Gray presented the following resolutions:—

WHEREAS, It is with heartfelt sorrow this Academy has been called upon to record the death of our respected honorary life member, Prof. Asa Gray, M. D., we desire to express our most sincere sympathy with the bereaved widow and relatives in their irreparable loss, and to join our grief with theirs as well as with the numerous scientific friends and associations in the loss to the world of science of so mature a scholar and able exponent of nature.

Resolved, That a copy of the memorial and resolution be affixed to the minutes of this Academy, and that one be forwarded to the widow of the deceased.

GEO. HEWSTON,
H. H. BEHR,
M. K. CURRAN,

Committee.

Dr. Hewston presented the following Memorial:

It is with more than ordinary feelings of sorrow that we have to announce that the useful career of one of the ablest and most industrious of our National Scientists has forever terminated; he having been called by that inexorable law of nature, to close a life of usefulness to the world of science, and enter that of the spirit. His genial and cheerful face shall no longer be seen in the shining sunlit fields, or his sweet and winning manners and voice, no longer in his lecture room instruct the hearts and minds of his students, or his hand in salutation his friends and co-laborers in science. Prof. Asa Gray is dead; "but his works remain impressed on the sands of time." To present the personal qualities of the man would be impossible in the time allowed for this short memorial.

To know him was to admire him; yea, truly love him. His gentle manner, cheerful smile and kindness of heart won all with whom he came in contact.

His heart was so full of kindness for the young and those struggling in the early walks of his favorite life pursuit, that no one was turned aside or suffered a feeling of littleness when in the presence of this giant of knowledge.

The greatness of his intellect was often seen when brought forth by the fullness of the heart and the kindness of his manner. As a scientist in his department he had few if any superiors, and I may say few equals. In his specialty he was acknowledged as one of the most thorough botanists living.

His industry was unparalleled. His life had been spent in developing the botanical fields of his native country and elevating the science of American botany to a level which has called forth the encomiums of his confrères of the old world.

His style of imparting information was agreeable and chaste. He was unflinching in the pursuit of truth. He was not one of those men who are

more bent on making new species than in working out the great problem of vegetable life and organization as manifest in variety.

When attacked by others he relied upon time to prove his views and not on petty retaliation through newspaper paragraphs or published pamphlets. No detraction of a fellow botanist was ever known to emanate from his pen—but in gentleness his views or difference would be stated.

He was not a mere book or closet naturalist. He travelled and investigated the fields and collected many of the plants he has described. Never shall I forget the joyful expression of his face when, for the first time he beheld and gathered some of the native plants in their natural habitat on the sand dunes near the Cliff House, on his first visit to this coast. I had the inexpressible pleasure of conveying him to the ocean side, and when he beheld a certain plant growing on the side of the sand dune, in his enthusiasm he could not wait for the horses to stop, but sprang from the carriage, and running to the spot elevated the plant in his hand and waved it in triumph, as though he had captured an invaluable prize. The plant was one he had described years before; it having been brought to the East in the botanical collections of the U. S. Exploring Expedition (under Commander Wilkes) of which expedition he was to have been the botanist, having received the appointment in 1834, but owing to delays in starting he resigned his post in 1837. He however was appointed to edit the *Phanerogamic*, part of the botany of that expedition, which was published under the auspices of the government of the United States in two volumes—one a large quarto of letter-press, the other a folio of plates which has become exceedingly scarce and valuable.

Dr. Gray is another striking example of the fact that the early training afforded by the study of medicine has furnished to science some of the most gifted and illustrious of her votaries, and has yielded her claim to some of the greatest minds in the walks and works of the collateral branches of the scientific field. Dr. Gray graduated in medicine at Fairfield College in 1831, but relinquished his profession and adopted the study of botany for his life pursuit.

He was one of the modern scientists who, like Huxley and Tyndall, did not entertain the idea that by popularizing his favorite branch he in any wise detracted from the scientific character of his own reputation, or the true value of his science. His juvenile works on physiological botany, "How plants grow"—and his "First principles of Botany," manifest the clear comprehension as well as the adaptability of his mind to the wants of his humblest followers.

In a paper (as early as 1835) presented before the New York Lyceum of Natural History, he described new, rare, and interesting facts relative to plants growing in northern and western parts of New York State which were so important and of such a striking character as to call the attention of the older botanists of that day to this new and rising genius in the botanical firmament; and it was a matter of surprise that in a field so thoroughly explored that a young man should bring to light several new species and dis-

sipate the confusion which had surrounded many others previously known.

In 1838 he became associated with his preceptor, the distinguished botanist Dr. John Torrey, in the publication and joint authorship of the *Flora of "North America,"* a work designed to give a brief description of all the known indigenous and naturalized plants growing north of Mexico. The abiding friendship which existed between these two great men is clearly shown and beautifully expressed in the dedication to Dr. Torrey: "almost twenty years have passed since the first edition of this work was dedicated to you—more than thirty years since as your pupil, I began to enjoy the advantages of being associated with you in botanical pursuits, and on a lasting friendship. The flow of time has only deepened the sense of gratitude to you from your attached friend."

The *Flora of North America* was suspended at the end of the *Compositæ* (this latter order was arranged mainly through the labors of Dr. Gray. The suspension was owing to various causes; chiefly to the new relations of our government in the extension of our territories by the annexation of Texas, the acquisition of California, and the Gadsden Purchase, which brought about a change in the phytographical boundaries of our country. Prof. Gray had resumed the revision of this work during his later years, but has left it unfinished. The *Gamopetalæ* being complete he was actively engaged upon the first part of the *Polypetalæ* just prior to his death.

From my earliest acquaintance with him he seemed deeply impressed with the importance of the botany of this coast. He made three visits to the coast for the purpose of study as well as relaxation; in all his visits he was accompanied by his devoted and loving wife, whose charming nature was so adapted to his that she had become an inseparable companion in his work as well as in his life. On his second visit he was associated with Sir Joseph Hooker, England's great botanist, then of Kew Garden.

Their visit was for the purpose of determining some occult point in relation to the *Coniferæ*. In order to accomplish their object they left the overland train at Reno, Nevada, and proceeded by easy stages through Nevada to the Calaveras Big Tree Grove, studying the habitat and all other peculiarities of the *Conifers* of the Sierras in their course, thus familiarizing themselves with points not to be derived from any other source than nature's own volume.

In describing the plants of this Coast, he has not failed to remember the names of the botanists and collectors connected with this Academy, assigning their names to new genera and species found in our State and adjoining localities. Thus we have *Kelloggia*, a new genus of *Rubiaceæ* plants. *Bolanderia*, *Stanfordia*, *Lemmonia*, *Plummera*, *Lyonothamnus*, *Greenella*, and many others.

With the botany of this coast his name will ever be most intimately associated, he having described and given names to many new genera and species, both in the monographs published under the auspices of the government and learned societies of the country, as well as the *American Journal*

of Science and Art, known as Silliman's Journal, of which he was one of the editors for a number of years.

He was greatly beloved by the immortal Darwin, in whose theory he delighted and also defended, in one of his best expositions of that school of thought, Darwiniana.

To enumerate the various important scientific papers and books, as well as the educational prints which emanated from his pen, would require too much of your time. I therefore shall omit them and close by stating that Professor Asa Gray, M. D., was born at Paris, Oneida Co., New York, November 10, 1810, and was elected a Professor of Botany in the University of Michigan, but never occupied the Chair; as he was elected to the Chair of Fisher, Professor of Natural History in Harvard University in 1842, which was prior to the opening of the University of Michigan; this professorship he retained at the time of his death, which occurred on the 30th of January, 1888, in the seventy-eighth year of his age.

March 5, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Gilbert Palache was elected a life member.

Jules Simon was proposed for membership.

Additions to Museum:—

Shells: *Succinea obliqua*, *Helix monodon*, *Helix albolabris*, *Helix alternata*, and others, by H. W. Turner.

Fossils: Eighteen shells, from Chasik Harbor, Cook's Inlet. Collected by Mr. Kendall; donated by Mr. Tallant.

Additions to Library:—

From correspondents..... 58

By donation..... 11

The following paper was read:—

Topographical Features of Lower California, by W. Lindgren.

Melville Attwood made some remarks on Determination of Form and Hardness of Crystals.

Ivan Petroff made an explanation of a map of the Kodiak Islands donated by him.

March 19, 1888.—STATED MEETING.

The PRESIDENT in the chair.

S. L. Theller was proposed for membership.

Additions to Museum:—

Forty-eight specimens of fish and three mollusks, collected at the Tahiti Islands by J. L. Young and donated by I. E. Thayer.

A vote of thanks was passed to Mr. Young and Captain Thayer for their valuable donation.

I. E. Thayer made some remarks on the abundance of fish at Tahiti.

Additions to Library:—

From correspondents.....	108
By donation.....	14

The following paper was read:—

Comparison of the Floras of Chile and California, by M. K. Curran.

April 2, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Charles F. Sonne was proposed for membership.

Additions to Library;—

From correspondents.....	116
By donation.....	56
By purchase.....	4

The President introduced Prof. P. V. Veeder, who delivered a lecture on Recent Changes in Japan.

A vote of thanks was passed to Prof. Veeder for his interesting and instructive lecture.

April 16, 1888.—STATED MEETING.

The PRESIDENT in the chair.

The following were proposed for membership:—

Wm. T. Baggett, Julius Koebig.

Additions to Museum:—

A specimen of lamprey (*Ammochætus cibarius*), taken from the bay by Dr. Geo. Hewston.

Dr. Hewston made some remarks in reference to the lamprey presented by him.

The President exhibited some pine branches which had been attacked by a parasitic fungus (*Peridermium Harknessii*), giving a brief description of its action and effect.

Additions to Library:—

From correspondents	83
By donation	21
By purchase	27

May 7, 1888.—STATED MEETING.

VICE-PRESIDENT HEWSTON in the chair.

S. L. Theller and Chas. F. Sonne were elected resident members.

Winslow Anderson was proposed for membership.

Additions to Museum:—

Native cloak from Tahiti, and carved hatchet and handle made by a native of the King Mills Group, South Sea Islands, presented by Mrs. Pauline Vandor.

Specimen of *Pandarus danæ*, by Dr. Geo. Hewston.

Specimen of Florida alligator, by C. S. Capp.

Specimen of bat from Carson City, Nev., by Walter D. Bliss.

Specimen of *Anarrhichthys ocillatus*, by purchase.

Additions to Library:—

From correspondents.....	115
By donation.....	27

The following paper was read:—

The Most Probable View Regarding the Condition of the Interior of the Earth, by Prof. Joseph Le Conte.

May 21, 1888.—STATED MEETING.

VICE-PRESIDENT HEWSTON in the chair.

Julius Koebig was elected a resident member.

Additions to Museum:—

One Lacerta, seven Helices, two Scorpions, two Ophidi-
ians, one Crustacean, two Cephalapods, two Lacertæ, two
Holothurians, one black rat; first three from Santa Margarita
Island, Lower California, the others from Magdalena Bay;
donated by Waltér E. Bryant.

Chimæra Colliæ from San Luis Obispo, water snake
from La Pama, Central America, and tortoise from Mexico,
by Capt. H. Kleinhammer.

Piece of coral and fish-hook from Tahiti, by I. E.
Thayer.

Additions to Library:—

From correspondents.....	96
By donation.....	11
By purchase.....	2

The following paper was read:—

Antiquities of Guatemala, by Gustav Eisen.

Dr. Behr made some remarks on Insect Pests, especially
the Army Worm.

June 4, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Two skins of Valley Partridge (*Callipepla californica vallicola*), male and female; one skin of Gambel's Partridge (*Callipepla gambeli*), by H. C. Thayer.

Four eggs of California Partridge (*Callipepla californica*), by M. S. Hurd.

Specimen of coral (*Astraea*), by Capt. H. Kleinhammer.

Additions to Library:—

From correspondents.....	82
By donation.....	8

The following paper was read:—

On the Measurement of Frustrums of Cones and Cylinders, by Josiah Keep.

Prof. L. A. Lee addressed the meeting on the work performed by the Albatross, U. S. Fish Commission steamship, during her voyage to San Francisco.

June 18, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Wm. T. Baggett was elected a resident member.

Additions to Museum:—

Eighty-four specimens of Birds, prepared by Walter E. Bryant; collected during the year 1887.

Specimen of Coyote (*Canis latrans*), by R. E. Rowland.

A vote of thanks was passed to Mrs. Eliza Baum for the donation to the Library of a valuable Atlas of Charts, in the Russian Language, of the North Pacific, particularly of Alaska and adjacent islands.

Additions to Library:—

From correspondents.....	83
By donation.....	35

The President announced the publication of the first part of Vol. I. Series 2, Proceedings of the Academy.

Prof. Frank H. Cushing delivered an interesting address on the ruins of Los Muertos.

July 2, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Collection of shells from Mrs. Van Gordon, of San Simeon; collected in that part of the State.

An arrowhead found in the Park of this city, by D. P. Secor, of Bridgeport, Conn.

Horned toad (*Phrynosoma*) and gopher snake (*Pityophis*), by Walter E. Bryant.

Special notice was called to the magnificent set of astronomical plates prepared by Trouvelot and donated by a member of the Academy, to whom a vote of thanks was passed.

Additions to Library:—

From correspondents.....	43
By donation.....	13

The following paper was read:—

Disproportional Multiplication of Vanessa Californica, by H. H. Behr.

July 16, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Lycoperdon sculptum, by R. A. Campbell.

Species of Pine from Sierras, with parasite growth; also Pajuella Insect, by Mr. Hittell.

Acorn enclosed in wood, by E. M. Willey.

Additions to Library:—

From correspondents.....	55
By donation.....	9

Prof. Ward made some remarks descriptive of the Museum at Coronado Beach Hotel.

August 6, 1888.—STATED MEETING.

The PRESIDENT in the chair.

F. H. Vaslit was proposed for membership.

Additions to Museum:—

A collection of exhumed articles from Los Muertos, by Lieut. Frank H. Cushing.

Collection of Shells, by Williard W. Wood.

Additions to Library:—

From correspondents.....	143
By donation.....	21

The following paper was read:—

Volcanoes in the Moon, by Edward S. Holden.

F. Gutzkow made some remarks explanatory of the manufacture on this coast of magnesia from sea water.

August 20, 1888.—STATED MEETING.

The PRESIDENT in the chair.

The President addressed the meeting as follows:—

It becomes my painful duty upon this occasion to announce to the members of this Academy the death of one who has ever been an esteemed friend and benefactor, Mr. Charles Crocker.

I need not recall the many evidences of his regard and attachment to this Society, as it is known to all of you that to him we are indebted for such timely aid as has largely contributed to our material progress.

The death of one who has been so helpful to us is deserving at our hands a fitting tribute to his memory, not only that his family may be apprised of our high estimation of his worth, and of our gratitude for his many acts of beneficence, but also that such testimonials may be preserved in our archives, so that coming generations may be informed that we, his contemporaries, fully appreciated his kindly acts.

Immediately upon learning of the death of Mr. Crocker the Trustees and the Council of the Academy met in joint convention for the purpose of determining upon a plan of procedure, such as the occasion seemed to demand. At said meeting a committee was appointed whose duty should be to draft a memorial and a set of resolutions which should be suited to the occasion.

I have to announce to you that the committee have completed their report, and they are now ready to present the same for your consideration.

The resolutions were then read and unanimously adopted. They are as follows:—

The California Academy of Sciences desires to record its grateful tribute of respect to the memory of its late member, Charles Crocker, who was born at Troy, N. Y., September 16, 1822, and died at Hotel del Monte, Monterey County, California, August 14, 1888.

His eminent services as one of the great pioneer railroad builders, uniting the Pacific Coast with the Atlantic borders, have become matters of public history.

His talents and industry surmounted early disadvantages, and soon gave him position among prominent business men, until the emergencies of the great struggle for national integrity demanded the transcontinental railroad. In this enterprise he enlisted and ventured his then moderate fortune with a courage and energy born of faith in his own convictions and in the patriotism of his countrymen. This design of constructing a great railroad system in this country he pursued with unabated zeal for more than a quarter of a century and until the close of his life.

Let those who enjoy the blessings of health, the pleasures of travel and the joys of social reunions attendant upon rapid and convenient transportation consider the enterprise, the courage, the invention, the labor and the risk of fortune devoted to the work by the great pioneer builders of the California railroads, among whom the deceased was one of the chiefs.

And this Academy has especial reasons to hold the name of Charles Crocker in unfading remembrance as one of its early and generous patrons, while it was without available means to advance the cause of science.

Becoming a life member he ever after evinced his constant desire to forward the work and interests of the Academy by his liberal donations for the prosecution of original investigation in science, and by his frequent contributions of natural history collections.

Therefore, it is recorded as the sense of this Academy that the example of Mr. Charles Crocker as a patron of science will serve as an inspiration and encouragement to those who love and labor for the same great cause; and that his name be gratefully and conspicuously enrolled in our archives, and also that it be suitably engraved upon the tablets of the edifice now in prospect of construction. It is further

Resolved, That we sincerely mourn the loss of the presence and the society of our late member and benefactor, Charles Crocker.

Resolved, That we tender our sincere sympathy to the widow and family of our late associate for the loss of their eminent husband and father.

Resolved, That the Secretary prepare and transmit to the family a copy of this memorial.

G. HEWSTON, M. D.,
S. W. HOLLADAY,
G. C. PERKINS,
H. W. HARKNESS, M. D.,
H. FERRER, M. D.,

Committee.

The resolutions were beautifully engrossed and handsomely bound.

The meeting then adjourned out of respect to the memory of the departed.

September 3, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Yellow-green Vireo (*Vireo flavoviridis*), by W. W. Price.

Western Warbler (*Dendroica occidentalis*), and Green-tailed Towhee (*Pipilo chlorurus*), by Charles Fiebig.

Perissodactyl foot of the pig, by David Thomas.

Fossil echinoderm, from Salinas River Valley, by H. H. Behr.

Freshwater shells and batrachians from Lassen County, by Walter E. Bryant.

Additions to Library:—

From correspondents.....	115
By donation.....	21
By purchase.....	1

The following paper was read:—

Earthquakes in California, Oregon and Washington Territory, by Edward S. Holden.

September 17, 1888.—STATED MEETING.

The PRESIDENT in the chair.

The proposition for membership of F. H. Vaslit was withdrawn.

Additions to Museum:—

Specimens resembling bronze, by F. J. McCulloch.

Specimens of stalactites from Paraiso Springs, by James G. Fair.

Additions to Library:—

From correspondents.....	61
By donation.....	9

The following paper was read:—

Comparative Mythology, by Adley H. Cummins.

Dr. Hewston made remarks in reference to a species of Banana plant growing in his front yard on Sutter street.

October 1, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Specimen of wood from tunnel 500 feet from surface at Placerville Mine, by D. B. Woolf.

Five specimens of birds, by W. D. Bliss.

Collection of birds' stomachs, by A. H. Hawley.

Twenty-six mammals, by Walter E. Bryant.

Additions to Library:—

From correspondents.....	62
By donation.....	8
By purchase.....	1

The following paper was read:—

Trees and Shrubs of the Sierra Nevada, by M. K. Curran.

Dr. R. G. Eccles, of New York, addressed the meeting.

October 15, 1888.—STATED MEETING.

VICE-PRESIDENT HEWSTON in the chair.

Additions to Museum:—

Specimens of *Zauschneria Californica* and *Cordylanthus filifolius*, Belding.

Fourteen herbarium specimens, by S. B. Parrish.

Stick of Poison Oak (*Rhus diversiloba*), 13 inches in circumference, by Walter E. Bryant.

One specimen of Snake, by Dr. Behr.

Specimen of *Coregonus Williamsoni*, fish stomachs, fresh-water sponges and polyps—all from Lake Tahoe, by Dr. Harkness.

Additions to Library:—

From correspondents.....	56
By donation.....	12

The following papers were read:—

Modern Chemistry in Agriculture, by Dr. Julius Koebig.

On the water supply of the Sutro Aquarium, by T. H. Hittell.

The President made remarks on researches at Lake Tahoe.

November 5, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Specimen of Flying Fish, by Alex. Selkirk.

Three specimens of Lizards, by Walter E. Bryant.

Nine Fish, by Fish Commission.

Specimens of snow plant (*Sarcodes sanguinea*), by C. F. Sonne.

Additions to Library:—

From correspondents.....	51
By donation.....	14
By purchase.....	12

The following paper was read:—

The Flora of the Santa Barbara Islands, by T. S. Brandegee.

The following papers were read by title:—

Botanical Notes, by Mary K. Curran.

Description of a new Fish, by Rosa Smith Eigenmann and C. H. Eigenmann.

Notes on *Sarcodes sanguinea*, by C. F. Sonne.

Astronomical Notes, communicated by Edward S. Holden.

November 19, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Museum:—

Several plants, from the Fish Commission, principally gathered in Alaska and British Columbia.

Additions to Library:—

From correspondence.....	113
By donation	18

The following papers were read:—

Magnesium Oxychloride, or Sorel's White Cement, and Favorable Conditions for its Manufacture in California, by F. Gutzkow.

The Great Glacier of the Selkirks, by W. R. Bentley.

December 3, 1888.—STATED MEETING.

VICE-PRESIDENT HEWSTON in the chair.

Additions to Museum:—

Two specimens whales' eyes, by Pacific Steam Whaling Company.

Specimen of flounder, by Walter E. Bryant.

Two sections of wood, by Mrs. S. A. P. Wheeler; prepared by H. S. Durden.

One hundred and twenty-one specimens of birds, by L. Belding.

Six skins of birds, by W. W. Price.

Five skins of birds, by A. H. Hawley.

Additions to Library:—

From correspondents.....	191
By donation.....	3
By purchase.....	3

The following papers were read:—

Notes on the Structure of the Basin Region, by Joseph Le Conte.

Identification of Coal Seams, by J. R. Scupham.

Dr. Hewston made some remarks concerning the new building of the Academy.

December 17, 1888.—STATED MEETING.

The PRESIDENT in the chair.

Additions to Library:—

From correspondents.....	141
By donation.....	7

The following paper was read:

The Change of Level of the Peninsula of San Francisco, by T. H. Hittell.

The following nominations for officers for the ensuing year were made:

President—H. W. Harkness.

First Vice-President—H. H. Behr.

Second Vice-President—George Hewston.

Corresponding Secretary—F. Gutzkow.

Recording Secretary—J. R. Scupham.

Treasurer—I. E. Thayer.

Librarian—Carlos Troyer.

Director of Museum—J. G. Cooper.

Trustees—C. F. Crocker, D. E. Hayes, S. W. Holladay, E. J. Molera, Irving M. Scott, George C. Perkins, John Taylor.

January 7, 1889.—ANNUAL MEETING.

The PRESIDENT in the chair.

The annual reports of the officers and board of trustees were received and referred to the Publication Committee.

The judges and inspectors of election reported the following officers elected for the ensuing year:

H. W. HARKNESS, *President*.

H. H. BEHR, *First Vice-President*.

GEORGE HEWSTON, *Second Vice-President*.

FREDERICK GUTZKOW, *Corresponding Secretary*.

J. R. SCUPHAM, *Recording Secretary*.

I. E. THAYER, *Treasurer*.

CARLOS TROYER, *Librarian*.

J. G. COOPER, *Director of Museum*.

Trustees:

CHARLES F. CROCKER,

E. J. MOLERA,

D. E. HAYES,

GEORGE C. PERKINS,

S. W. HOLLADAY,

IRVING M. SCOTT,

JOHN TAYLOR.

REPORT OF THE PRESIDENT.

The reports of the officers and curators of the Academy, just read, show a very gratifying amount of activity, both in the scientific work of the Society and in matters relating more directly to its income, the housing of its steadily increasing collections, and accommodations for the working sections.

The Museum has been much increased, especially in the departments of Birds and Mammals, and in Botany, both by donation and by exchanges brought about by the efficient curators.

When the Society is in a condition to provide working facilities for other departments, it is hoped they will become equally active.

Early in the present year Walter E. Bryant made a visit to Lower California in the interest of the Society, in order to study the habits and secure good specimens of its birds and mammals. A stay of a few months enabled him to make large accessions to our ornithological collections. Being alone, he was unable to penetrate the interior sufficiently to secure a complete series, especially of the mammals, and it is hoped that the Society will undertake at once the fuller exploration of this still almost unknown field which lies at our doors, and promises so rich a reward in material for scientific investigation, before it shall have been stripped by explorers sent out by Eastern and foreign societies.

The exchanges with foreign societies, whereby our Library is mainly increased, have been kept up and largely extended, and subscriptions have been made to the principal scientific journals which cannot be obtained by exchange.

The bibliographic catalogue of the Library has been completed to date, and will be published in the forthcoming volume of our proceedings. I need not inform you that such a catalogue will prove to be a great convenience to members and others who may wish to consult scientific works.

We have published during the year two parts, the first on the Anatomy of a New Annelid; the second, on Antiquities of the Pacific Slope of Guatemala—both by Gustav Eisen—of the second volume of our Memoirs, and the title-page and index of Volume I, which remained without those necessary adjuncts for twenty years. Index and title-page has also been printed for Proceedings VII, Part I, completing the volume, now twelve years old.

The second series of Proceedings has been commenced by the publication of Part I. Part II embracing, in addition to the papers, the proceedings proper of the last two years, and completing the volume, is now in press, and will be issued during the present month.

The papers read before the Academy during the year

have many of them been of great merit. A few of them were not intended for publication in our proceedings, either because they are principally of local interest, and reach a more satisfactory audience by publication in some of the local journals of our city, or their novelty is not great enough to warrant the great expense involved.

Its publications are the very life of a society like ours—the only means whereby its existence is known to the world of science, and the medium of steady increase of its library. Its audience is almost entirely among working scientists, and its standing is determined by the number of and importance of its contributions to the sum of the world's knowledge.

We have lost by death during the year one life member, our benefactor, Charles Crocker, whose services to the Society are fresh in the minds of us all, and two resident members, Henry W. Reese and Joseph Durbrow.

Among our honorary members we have met a loss, the like of which cannot soon occur again. Dr. Asa Gray, the head of American botany, died January 30, full of years and honors, yet in the prime of his faculties and usefulness. The position which he held will never again be filled. While there will be, as heretofore, numerous specialists engaged in the different departments of botany, we may never meet with one who possesses so comprehensive a knowledge and a judgment so sound in all that relates to that important branch of science.

The income from the fund created by the late Charles Crocker, has been expended, as in former years, for the promotion of original work, and the work so performed will compare favorably with that of any previous year.

The Society is to be congratulated upon the fact that the Trustees are actively engaged in making preparations for the erection of a new building for Academy purposes, the ground having been prepared for its foundation, and ample funds are at hand for its completion.

In the plans already adopted by the Trustees, provision is made not only for an Academy building, with ample space for the display of our large collections, together with the library and all of the rooms necessary for a large staff of workers as well.

In addition to the Academy proper, the Trustees are preparing to erect upon a portion of our property a large and commodious building for the purpose of revenue, the income from which, it is to be hoped, will be sufficient to meet the outlay which is necessary to carry forward our work.

A year or more will be required for the completion of these buildings and the removal of our collections to the new quarters.

Finally, I have to thank our Board of Trustees for the efficient aid which they have rendered in the prosecution of our work. In no case has there been any hesitation in granting the necessary funds as the needs of the Academy seemed to require; and in behalf of my fellow members of the Council, I thank them for the uniform courtesy which they have ever shown us.

REPORT OF THE CORRESPONDING SECRETARY.

During the past year the following publications have been distributed to members: *Memoirs*, Vol. II, No. 1 and 2; and *Proceedings*, Vol. I, Part 1. A special circular was sent to many of the members, inquiring as to what publications they had already received, and the numbers missing were furnished to them whenever possible.

Two hundred and seventy-eight letters were received, and also a large number of receipts, which have been numbered and classified.

Ninety-three letters have been written and copied, mostly concerning the library.

Our exchange list with foreign societies has been largely increased.

REPORT OF RECORDING SECRETARY.

Number of meetings during year, 24, for which notices were sent out.

Number of members elected, five.

REPORT OF THE TREASURER.

Balance in bank, January 1, 1888.....\$ 1,847 22

RECEIPTS DURING THE YEAR.

Dues Active Members.....	\$ 1,183 50
Life Membership.....	100 00
Rent of Market Street property.....	4,671 00
Interest on Crocker Fund.....	1,200 00
Cash returned from W. Lindgren.....	13 05
Cash borrowed from Lick Trustees.....	5,000 00

Total.....	\$14,014 77
Expenditures.....	11,078 71

Balance on hand.....	\$ 2,936 06
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EXPENDITURES.

Account of Crocker Fund.....	\$ 1,210 00
Salaries.....	1,250 00
Rents	1,950 00
Office Furniture and Fixtures.....	146 65
University of Indiana for alcohol.....	29 05
Petty Expenses, Contingent Fund, care and preservation of Specimens.....	711 51
Publications	847 02
Interest on Lick Loan.....	275 00
Insurance	180 00
Taxes on Market Street property.....	2,891 43
Architects' premiums for new building designs..	900 00
Sidewalk Market Street property.....	27 55
Purchase of books.....	180 00

Expert for examination of books.....	\$220 00
Expenses of collectors of specimens.....	260 50
Total.....	<u>\$11,078 71</u>

SUMMARY—GENERAL FUND.

Balance on hand, January 1, 1888.....	\$ 1,086 20
Receipts.....	10,967 55
	<u>\$12,053 75</u>
Disbursements.....	9,868 71
Balance, January 1, 1889.....	<u>\$ 2,185 04</u>

CROCKER FUND.

Balance on hand January 1, 1888.....	\$ 761 02
Receipts.....	1,200 00
	<u>\$1,961 02</u>
Disbursements.....	1,210 00
Balance January 1, 1889.....	<u>\$ 751 02</u>

REPORT OF THE LIBRARIAN.

The 36th Annual Report of the Librarian for the year 1888 is herewith respectfully submitted :

Number of publications received—

From correspondents	2,250
By donation.....	303
By purchase.....	94

Total No. of publications received.....2,647

No. of volumes completed..... 651

Several journals of current scientific literature have been subscribed for, and the registering of accessions and bibliographic index by card catalogue, has been steadily kept up and completed to the close of the year, while the cataloguing by subject and author, has received such attention as time permitted.

REPORT OF DIRECTOR OF MUSEUM.

The state of the collections contained in the museum has not been materially changed during the past year except in the departments which are in charge of working curators. In these departments there has been marked progress, both in the line of original investigation and in the increased size of the collections.

As it is necessary to store most of the collections until the new building is completed, full justice cannot be done in the departments of which reports are here appended, and in other branches it has sufficed that the material on hand has been given a general oversight, and that proper care was bestowed upon acquisitions.

In the entomological department the accessions number 1,989 classified as follows :

Coleoptera, 1013 ; Hemiptera, 144 ; Orthoptera, 42 ; Diptera, 45 ; Hymenoptera, 437 ; Neuroptera, 32 ; Lepidoptera, 255 ; Arachnida, 21 ; making a total of 23,907 specimens in the collection.

The acquisitions from various donors are as follows :

Attwood, Melville, San Francisco, Cal.: 6 points for testing hardness of minerals.

Bliss, Mrs. D. L., Carson City, Nev.: 1 specimen beetle (*Cerambycidae*).

Bryant, Walter E., San Francisco, Cal.: 1 specimen fish (*Paralichthys*) from Oakland market.

Capp, C. S., San Francisco, Cal.: 1 young alligator.

Cobbledick, James, Oakland, Cal.: 2 specimens *Amblystoma tenebrosum*.

Durden, H. S., San Francisco, Cal.: 9 specimens wood.

Fair, James G., San Francisco, Cal.: 1 specimen calcareous tufa from Monterey Co.

Ferrer, Dr. Henry, San Francisco, Cal.: 30 volcanic specimens from Hawaiian Islands.

Harkness, Dr. H. W., San Francisco, Cal.: 5 specimens of fossil shells.

Hewston, Dr. George, San Francisco, Cal.: 1 cast of fossil jaw of *Titanotherium proutii*, and 1 specimen fish *Ammocetes cibarius*, from San Francisco market.

Kleinhammer, Capt. Henry, 1 specimen *Pelamys bicolor*, 1 tortoise and 1 specimen of coral.

Petroff, Ivan, Alaska: 22 specimens of fossil *Inoceramus* from Alaska.

Thayer, Capt. I. E., San Francisco, Cal.: 48 specimens Tahiti fish; 3 crustaceans, 1 pearl fish-hook and 1 mollusk from Tahiti.

Turner, H. W., San Francisco, Cal.: 6 boxes insects and 5 specimens of shells.

Vandor, Mrs. Pauline, San Francisco, Cal.: 4 Ethnological specimens and 4 specimens of shells from South Sea Islands.

Van Gordon, Mrs., San Simeon, Cal.: 1 box of shells.

Wethered, J. S., San Francisco, Cal.: 5 fossil teeth of shark and 1 rose-colored crystal.

Purchased from San Francisco market, 1 specimen fish (*Anarrhichthys ocellatus*).

The Director also has in his hands a large collection to be added in the new building.

REPORT UPON THE DEPARTMENTS OF MAMMALS AND BIRDS.

By WALTER E. BRYANT, CURATOR.

The past year has been an exceptionally favorable one to the departments of mammals and birds.

At no time in the history of this society have the accessions of valuable study specimens been so large. Unless there are specimens stored of which the curator has no knowledge, the additions of bird skins alone for the year number nearly three times more than were contained in the entire study collection on January 1, 1888.

Large as has been the receipt of specimens, the number is small in comparison to what might have been added had there been any satisfactory way of caring for the specimens which were received in the flesh. These were, with the exception of one mammal and six birds, all prepared by the curator, assisted in a few instances by Mr. Charles Haines.

That there is not attached to the museum some competent person who could prepare, in *first-class manner*, the accessions of mammals and birds in the flesh, is greatly to be regretted, for there are many individuals who are willing and anxious to aid the society by valuable donations of this nature, but whose offers of fresh material have been repeatedly declined for no other reasons than that it incurred an expense when sent to local taxidermists, or occupied the time of the curator and janitor needed at other work.

A plea to sportsmen and others for donations of fresh material, and also a museum circular treating of the complete care and preparation of mammals for scientific purposes, which was written by the curator, has not been circulated, nor even printed, there being no provision for the care of such specimens which would certainly be received. An early change in regard to this really important matter is earnestly hoped for.

Another museum circular, similar in plan to the one on mammals, has been partly written—treating of birds—but not completed for the reasons just given.

A label for the use of these departments has been designed in three sizes. These labels will be attached to those specimens which are now designated only by the field collectors' numbers, and to others that may require them.

A careful inspection of the entire collections was made in December, with very satisfactory results; the specimens are believed to be absolutely free from insect pests of any kind.

A manuscript catalogue of all the skins in the study series has been made, and the specimens numbered to correspond.

In connection with this work reference was made to back numbers of the "Proceedings" and the minutes of former years, wherein were found occasional notices of accessions which the curator has failed to find any trace of. It is to be hoped that these are not lost, but packed away, and will eventually be restored to the society.

The field work of the curator has consisted in about four months' explorations in Lower California; a month's sojourn in Lassen county, Cal.; a trip of one week in the vicinity of Mt. Hamilton; and several short visits to Sonoma county, besides a number of brief excursions in the vicinity of San Francisco—at all of which places collections were made. In all, more than six months have been spent in the field.

The original work of investigation has consisted in the description of a bird new to science (*Melospiza fasciata rivularis*), and the preparation of a report upon the collection of birds made this year in Lower California: this last is in MS., but it was thought best to delay its publication until the following year, by which time a great deal of additional information is expected.

Several lots of bird skins have been received for identification; this having been made, the specimens were returned to the owners.

Field notes pertaining to the life histories of Pacific Coast mammals and birds have been kept, for use in future publications.

A collection of 124 bird skins from Mr. W. W. Price has been deposited for identification and the use of the curator.

Microscopical examinations have been made of the contents of the crops and stomachs of birds, disclosing some interesting facts relating to the food habits of Californian birds.

No exchanges have been undertaken; not because no offers were received, but for lack of duplicates to send in return.

For obvious reasons no specimens were purchased for these departments.

The addition of more cases of an approved model is much needed for the study series of birds, particularly the large ones.

The transfer of the curator's quarters to the first floor, with facilities for heating the room, has added much to his comfort, and protected the specimens from dampness and mold.

To the members of this society, and others who have aided by contributions and encouragement during the year, thanks are cordially extended.

The accessions for the year ending December 31, 1888, are classified as follows:

Belding, L., Stockton, Cal.: 131 specimens of bird skins, 85 species principally from California and Lower California.

Bliss, Walter D., Carson City, Nev.: 2 specimens of *Tamias harrisi* in flesh; 1 specimen of bat in flesh; 15 specimens, 9 species, birds in flesh from Nevada.

Bryant, D. S., Healdsburg, Cal.: 1 specimen *Accipiter cooperi* in flesh.

Bryant, Walter E., Curator: 28 specimens, about 20 species, mammals; 239 specimens, about 147 species, birds.

Fiebig, Chas., Eureka, Cal.: 1 specimen *Dendroica occidentalis*, and 1 specimen *Pipilo chlorurus*.

Haines, Chas. D., Oakland, Cal.: 1 specimen *Thomomys talpoides bulbivorus* in flesh.

Hawley, A. H., Los Gatos, Cal.: 7 specimens, 3 species, birds in flesh; also, 5 skins of *Petrochelidon lunifrons*, and a collection of birds' crops and stomachs.

Haynes, John, San Francisco, Cal.: Two live young of *Trochilus anna* in nest.

Heaton, T. L., Oakland, Cal.: 14 specimens, 11 species, of birds in flesh from Sonoma county.

Hurd, M. S., Oakland, Cal.: 4 eggs *Callipepla californica* from Haywards, Cal.:

Kelsey, Mrs. W. F., Visalia, Cal.: 2 specimens *Melanerpes formicivorus bairdi* in flesh.

Kellogg, Chas. W., Oakland, Cal.: 1 specimen *Olor columbianus* in flesh, from Cordelia.

Pacific Steam Whaling Co., San Francisco, Cal.: 2 whale's eyes.

Parker, H. G., Carson City, Nev.: 2 eggs and nest of *Zenaidura macroura* from Marin county.

Price, W. W., Riverside, Cal.: 1 specimen *Thomomys talpoides umbrinus*, and 1 specimen *Neotoma* sp.? from Arizona; also, 4 specimens, 3 species, birds from Arizona, and 1 specimen *Vireo flavoviridis* from Riverside.

Rowland, R. E., Oakland, Cal.;: 1 specimen *Canis latrans* in flesh.

Swain, A. P., Oakland, Cal.: 1 specimen of *Colaptes cafer* in flesh, and 1 specimen of *Ceryle alcyon* in flesh, both from Sonoma county.

Thomas, David, Susanville, Cal.: 1 perissodactyl foot of a pig.

REPORT UPON THE DEPARTMENT OF BOTANY.

MARY K. CURRAN, CURATOR.

The herbarium, which is estimated to number about 30,000 species, is in good order but is becoming cramped for room. The additions during the year have been many and valuable. Exchanges are freely made from the duplicates, for any obtainable species which are wanting—or often for fuller material. The sets of certain exploring botanists which can only be obtained by purchase are much needed, and the want of literature is severely felt.

Philippi, Dr. R. A., Santiago de Chili: a very valuable collection of over a thousand specimens, received early in the year. (Partly in exchange for a package sent him by the curator, partly donated.)

Parish, S. B., San Bernardino, Cal.: 50 specimens. (Donated.)

Cleveland, Daniel, San Diego, Cal.: 20 specimens. (Donated.)

Hickman, J. B., Watsonville, Cal.: A few rare specimens. (Donated.)

Bryant, Walter E.: 130 specimens, including many rare and several new species from Magdalena Bay and Comondú, Lower California. (Donated.)

Heaton, T. L., Oakland, Cal.: 100 specimens. (Donated.)

Sonne, C. F., Truckee, Cal.: 150 specimens. (Donated.)

Eisen, Dr. Gustav, Delano, Cal.: 112 specimens. (Donated.)

Brandegge, T. S., Berlin, Conn.: 500 specimens. (Donated.)

Scupham, J. R., Oakland, Cal.: 50 specimens. (Donated.)

Townsend, C. H.: 50 specimens. (Donated.)

Hasse, Dr. H. E., Los Angeles, Cal.: 100 specimens. (By exchange.)

Shockley, W. H., Candelaria, Nev.: 75 specimens. (By exchange.)

Blanchard, Dr. F., Peacham, Vt.: 150 specimens. (By exchange.)

Curator: 300 specimens.

To many others whose names are not mentioned above thanks are given for specimens, often of living plants, and valuable notes.

REPORT OF THE BOARD OF TRUSTEES.

BY CHARLES F. CROCKER, PRESIDENT.

The Board of Trustees of the Academy, in accordance with the provisions of Section 4 of the Constitution of the Society, presents herewith its annual report for the year 1888.

The members of the Board, duly elected, met at the office of the Trustees on the 16th of January, and completed their organization by selecting Charles F. Crocker president, S. W. Holladay president *pro tem.*, and E. J. Molera secre-

tary *pro tem*. Duly executed bonds of the Treasurer, Director of the Museum, and Librarian, were received, examined and approved, in accordance with the provisions of Section 3 of the Constitution.

Very early in the year your Trustees definitely decided to improve the lot on Market street, near Fourth, by the erection of a building suitable for the accommodation of the Academy, as well as making provision for renting stores and rooms, whereby an income may be relied upon.

In view of the importance of this work, the entire Board of Trustees was appointed to serve upon the Prudential or Building Committee, the details of various branches of the work being attended to by sub-committees. Arrangements were promptly made with the trustees of the Lick Estate for a loan to cover the cost of the improvements, in the sum of \$200,000, the money to be drawn in various sums from time to time, as the work progressed. Trustee Holladay was appointed Attorney of the Board, and was authorized to associate with himself the firm of Mastick, Belcher & Mastick, should he desire to do so.

In April circulars were issued to various architects, inviting them to submit plans for two buildings on the Market-street lot, one fronting on Market street, to be rented for general commercial purposes, and a separate building in the rear, designed for the exclusive use and accommodation of the Academy, and to be thoroughly fire-proof. Several plans were submitted, and after due consideration at several meetings, in some of which the members of the Council joined, a contract was made with Messrs. Percy & Hamilton, covering the construction of the building upon plans made up of modifications of those presented, agreed upon by Trustees and Council in joint meeting.

Much consideration has been given to the matter of making an arrangement with the Society of California Pioneers

and the representatives of Miss Flood, for the use of "Pioneer Court," to obtain access to the Academy's building from Fourth street. This would be a very great convenience to the members of the Academy and the public in attending our meetings and visiting our museum, and would not in the slightest degree affect the conditions whereby the Pioneers and the tenants of Miss Flood's building now use this court. We have offered to pay a considerable sum of money for this privilege, and in addition, to change the plans of the walls of our building so as to provide for light and ventilation to the Pioneers' building in the greatest possible degree. Various committees of your Trustees have waited upon the representatives of these interests, and many interviews have taken place, but the efforts we have made in the matter have failed. We are asked, as a consideration for the opening of this court, that it should be extended through to the westerly line of our property. This would be a sacrifice of all that portion of the Academy's lot south of a point 145 feet from Market street, comprising an area of 7,200 square feet. We could have but one building upon the lot, and that—exclusive of the ground-floor—would, in the judgment of your Trustees, be insufficient for the Academy. We have determined not to make this sacrifice, and the plans have accordingly been made with a view of reaching the Academy's building from the Market-street entrance only. The grading of the lot, preparatory to putting in the foundation, has been finished, and we confidently expect that by the time your Trustees present their next annual report the building will be ready for occupation.

The complications which arose during the year 1887, through the action of the Board of Supervisors of this city in adopting resolutions to utilize the lot of the Academy on First Avenue, continued. By resolutions adopted on the 19th of December, 1887, your Trustees formally accepted this lot, and the President forwarded a certified copy of the resolutions to the Mayor and Supervisors of this city and

county. On the 5th of March, 1888, the Trustees authorized a protest to be filed with the Board of Supervisors, against granting permission to the Board of Education to erect a school-house upon this lot, and subsequently filed a similar protest with the Board of Education. Notwithstanding this action, permission was granted, and the school-house was completed. Your Trustees consider the title of the Academy to this lot perfect, and will assert its rights at the proper time.

In October the Secretary was authorized to procure a set of account books, and to keep a complete account of the financial transactions of the Trustees. This had never been done, the only books in the hands of the Secretary being the bank pass-book, memorandum of vouchers audited, and the vouchers themselves. The services of an expert accountant were obtained, and all books and papers in the hands of the Trustees were written up and classified, and a new set of books opened.

The expenses of the Academy have been considerably in excess of its ordinary receipts, and in December the Trustees were compelled to borrow \$5,000 from the Lick Trustees for one year, at 5½ per cent., making in all \$10,000, which is now due them. The unusual expenses were on account of grading the Market-street lot, plans of the architects, the publications of bulletins, and general scientific work. The receipts from the Crocker Scientific Investigation Fund have amounted to \$1,200, and the disbursements for services and expenses properly chargeable to it were \$1,210.

No official communication has been received from the Trustees of the Lick Estate during the year, of the present condition of the Trust, but from private sources we learn that the amount to be received in the distribution of the residue of the Lick Estate will exceed all previous estimates.

The personal property of the Society, as noted in the last annual report, together with additions which have been

made to the collection of specimens and to the library, remain in good condition, though it is very desirable that they be moved to a dryer place and systematically classified.

The Bank of California was selected as a depository of the funds of the Academy; the bonds belonging to the Crocker Scientific Fund, deeds and other valuable papers, are kept in the box rented by the Trustees in the vaults of the Safe Deposit Company.

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ADDITIONS AND CORRECTIONS.

Page 7, for "*Epidonax*" read "*Empidonax*."

" 29, eleventh line from bottom, for "*flyi*" read "*layi*."

" 101, twenty-first line from top, for "*joint*" read "*point*."

" 119, line 12, "*Poeyi*" should be "*poeyi*."

" 119, line 9 from bottom in list of new forms add "*37, Neoplecostomus*."

" 121, line 4 from bottom, "*Pirinampus*" should be "*Pinirampus*."

" 121, line 3 from bottom, "*Pirinampus*" should be "*Pinirampus*."

" 136, line 20, No. 72, "*reticulata*" should read "*reticulatum*."

" 148, second column, 4th line, "*wide*" should be "*deep*."

" 158, line 12, No. 194, "*accipenserinus*" should be "*acipenserinus*."

" 161, line 1, "*longipinnis*" should read "*longispinis*."

" 164, line 14, "*II CATAPHRACTUS Bloch*" should be "*CALlichthys Cuv. & Val.*"

" 164, line 15, "*Callichthys*" Cuv. & Val. should be "*Cataphractus Bloch*, pre-occupied in Mammals."

" 164, lines 16 and 23 species numbered 2 and 3, "*Cataphractus*" should read "*Callichthys*."

" 167, line 5, "*Gronowius*" should be "*Gronow*."

" 172, line 14, "*Pimelodine*" should be "*Pimelodina*."

" 172, line 17, the words "*Rio das*" should be omitted.

NOTE ON *Ceanothus Veitchianus*, Hook, &c.

BY WILLIAM TRELEASE.

An examination of the type of this species in the Kew herbarium shows that it is closely related to *C. thyrsiflorus*, though with characters of the *dentatus* group. Whether it be an autonomous species may still be an open question, but for the present I should so modify the group "****" in my list (Proceedings, p. 108) as to include it, thus:

* * * Flowers blue; inflorescence ample, on leafy branches or, when very compound, on a series of densely flavored leafless terminal shoots: twigs sulcate or ribbed: leaves pale below, medium-sized or smaller (10 to 50 mm. long), 3-nerved in the first which has the veins very prominent below, rather coarsely dentate to minutely glandular-serrulate: fruit mostly 5 to 6 mm. in diameter in the first.

C. THYRSIFLORUS, Esch.

C. VEITCHIANUS, Hook.—Twigs very low-ribbed: leaves round to obovate, cuneate, mostly with coarser teeth, the margin revolute between the teeth, scarcely triple-nerved: inflorescence rather more congested: fruit unknown.—Bot. Mag. pl. 5127.—Possibly a hybrid between the preceding and some one of the *dentatus* group.

It would also be more natural to allow *C. Parryi* with the characters of "++" to precede "→" on p. 109 of my list.

Page 204, second line from bottom, for "specius" read "species"

" 206, sixteenth line from bottom, for "Delphinum" read "Delphinium."

" 214, sixth line from bottom, for "chrsanthemifolia" read "chrysanthemifolia."

" 235, eighth line from bottom, for "he considers" read "they consider."

" 236, sixteenth line from bottom, for "California" read "Californian"

Note on *VISCAINOA* GENICULATA (Kell.)

Dr. Watson, in the latest of his Contributions, recognizes *Viscainoa* while stating that it is nearly allied to *Chitonia*, and the latter genus being known to me only by description, I accept the opinion of one who must be more fully informed upon the merits of the case, and the advisability of retaining two monotypic genera so closely related.

It was supposed that the notice of this plant on page 228 was free from ambiguity, but as misapprehension seems to have arisen, it is here explained that in the state of uncertainty as to its relation to *Chitonia*, the names were all Italicised in the order of their dates. A similar plan was followed in the case of *Marah minima*, the present position of which, in classification, I had not time to determine.

The history of *Viscainoa* is as follows: Described first by Dr. Kellogg, Proc. Cal. Acad., ii., 22. Noticed by the present writer in List of Dr. Kellogg's plants, Bull. Cal. Acad., i., 133. Distributed as *Chitonia simplicifolia* by C. R. Orcutt; Dr. Palmer's distribution I have not seen. Described as *Viscainoa* by Mr. E. L. Greene, in Pittonia i., 133, and classified on page 208 of the same publication in the list of Cerros Island plants. In both the two places last cited, the genus is referred to Euphorbiaceæ, next to Simmondsia, impliedly in the first, and directly, although the flowers were then known, in the second. This view was not, however, original with the author, as one would suppose from the text. The following label, in Dr. Kellogg's well-known handwriting, which accompanies the original specimens, and dates back at least ten years, shows conclusively to whom the credit should belong:

Veatchia fruticosa, K. (? in abeyance) Cerros Island, Dr. Veatch. *Simarubea*?—think not. *Euphorbiaceæ* most likely. NB. A former notice in vol. ii., Proc. Cal. Acad., p. 22, under *Staphylea*? *geniculata* K.—which it certainly is not.

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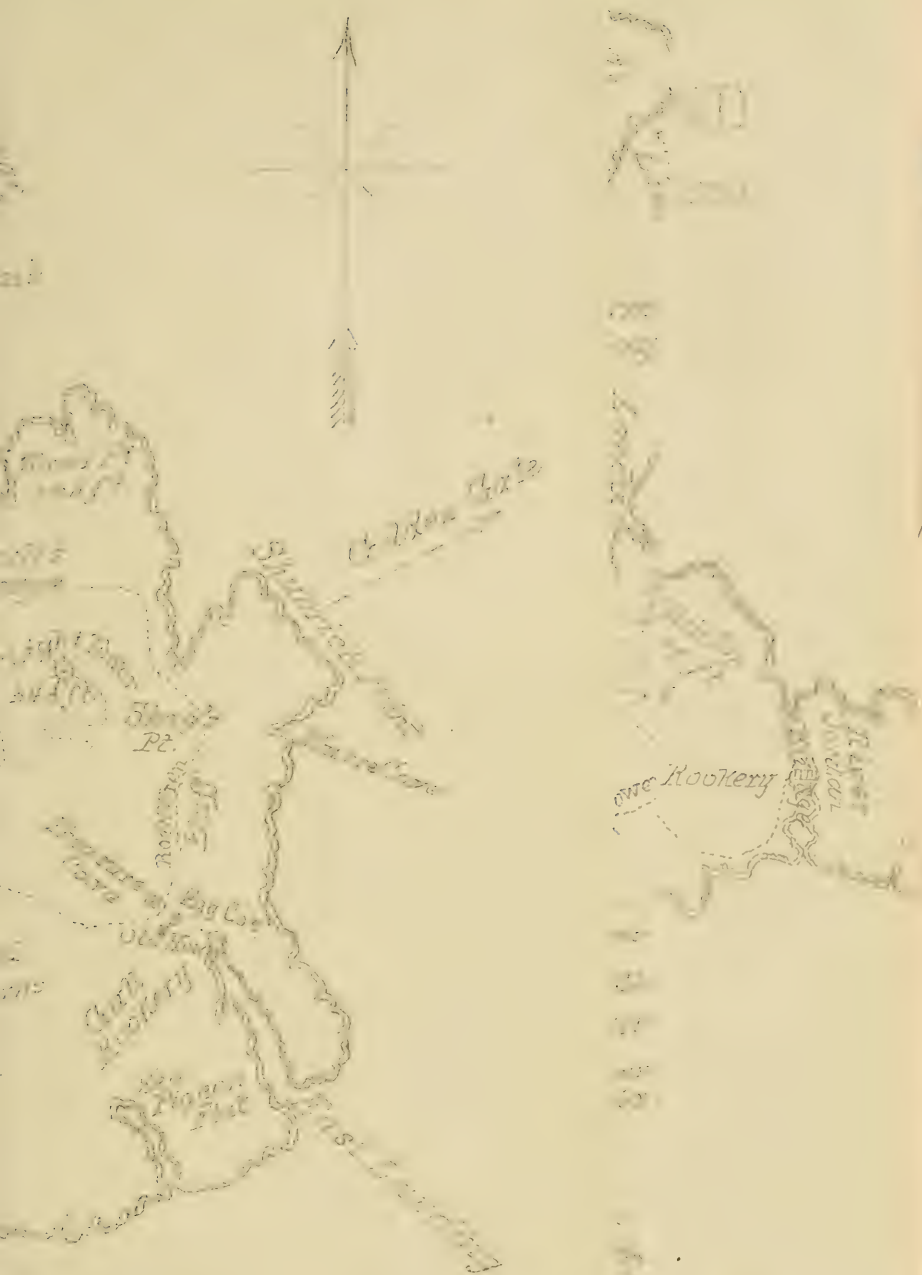
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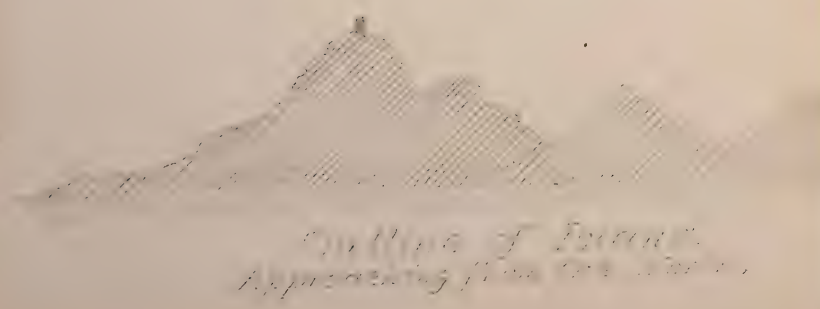
Island,
the North.

MAP OF

HAWAIIAN ISLAND

30 Miles out from San Francisco.

W.O. Emerson.



Outline of Islands.
Approaching from the West.



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 Ft. Yuma.

Plate II.

Arizona.

Sonora.

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California.

Plate II.

Boundary between Mexico and the United States.

NEW RIVER BASIN.

Arizona.

Sonora.

Gulf of California.

Map
of a part of
Baja California,
Mexico.

Scale: 1 Inch = 100 Miles.

(Based on Charts by the U.S. Hydrographic Office.)

W. Lindgren.

L

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5

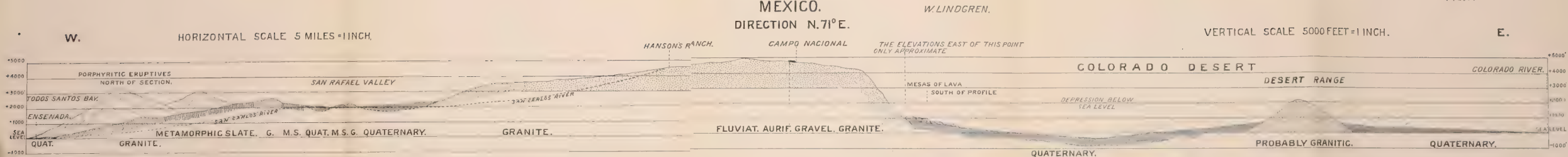
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Anima

GEOLOGICAL PROFILE
FROM
TODOS SANTOS BAY TO THE COLORADO RIVER.
BAJA CALIFORNIA,
MEXICO.
DIRECTION N.71°E.

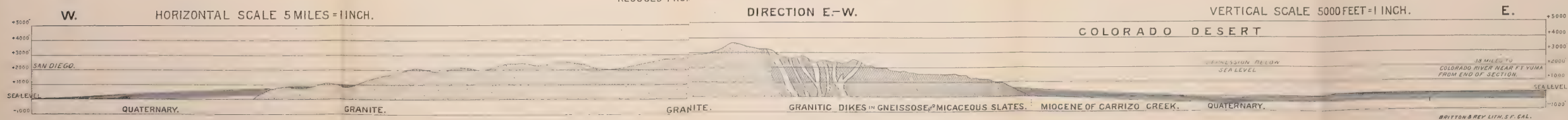
PLATE III

FIG. 1.



GEOLOGICAL PROFILE
FROM
SAN DIEGO TO THE COLORADO DESERT.
CALIFORNIA, U. S.
REDUCED FROM PROF. BLAKES PROFILE IN THE PAC. R.R. REPORTS
DIRECTION E.-W.

FIG. 2.



BRITTON & REY LITH. S.F. CAL.

GEOLOGICAL SKETCH MAP
OF
TODOS SANTOS BAY.

BAJA CALIFORNIA,
MEXICO.

SCALE $2\frac{1}{2}$ MILE = 1 INCH.
W. LINDGREN.

LEGEND

-  GRANITE.
-  MESOZOIC ERUPTIVES.
-  GENOZOIC OR RECENT ERUPTIVES.
-  CRETACEOUS
-  QUATERNARY





SAN RAFAEL VALLEY.

BAJA CALIFORNIA,
MEXICO. *W. LINDGREN.*

VERT. AND HORIZ. SCALE 1 MILE = 1 INCH. E.

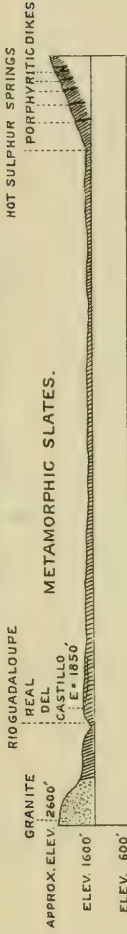


FIG. 1

FIG. 1

PROFILE
ACROSS

PUNTA BANDA.

BAJA CALIFORNIA,
MEXICO. *W. LINDGREN.*

HORIZ. SCALE. 1 MILE = 3 INCHES. S.

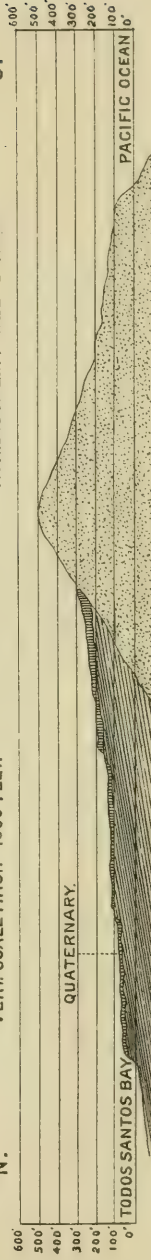


FIG. 2.

FIG. 2.

CRETACEOUS.

MASSIVE DIORITIC AND PORPHYRITIC ROCKS.

OF WASHINGTON, D. C.

PROCEEDINGS

OF THE

CALIFORNIA

ACADEMY OF SCIENCES.

SECOND SERIES.

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